The EtherCAT-based robot safety controller optimized for industrial robots

Robot Safety Controller (DRSC-HA)

User Manual
(R1) Version 1.6

DAINCUBE Corp.

Note: The contents may differ depending on the manual version.

2019.03.25

Preface

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Safety precautions

Be sure to observe all of the following safety precautions.

Strict observance of these warning and caution indications are a MUST for preventing accidents, which could result in bodily injury and substantial property damage. Make sure you fully understand all definitions of these terms and related symbols given below, before you proceed to the manual.

Symbols

The following symbols may be used in this specification:

⚠ **Warning:** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury or damage to the equipment. Be careful of handling and handling.

❗ **Caution:** Indicates that you must do this.

🚫 **Prohibition:** Indicates that you should never.

Revision history

Revision	Data	Comment
Version 1.0	2016.12.24	Initial Version
Version 1.1	2017.03.08	Manual form change, adding I / O port description
Version 1.2	2017.04.27	Adding operation sequence and timing diagram, EtherCAT contents
Version 1.3	2017.07.21	Apply V0.5 board content, change connector and pin map, add mechanical drawing
Version 1.4	2017.11.23	Change the connector, the appearance of board and case, add hall information, add System I / O setting menu, modify pin map.
Version 1.5	2018.02.09	Change the appearance of board
Version 1.6	2019.03.25	Add : EtherCAT PDO description. Modify : Signal name partially, Wiring to connector form, Connectors specification.

Contents

User's Manual

1. Summary

This safety information covers functions related to the operation of industrial robots. This information does not cover how to design, install, and operate the entire system and does not cover all peripherals that may affect the overall system safety.

To protect personnel, the entire system must be designed and installed in accordance with the safety requirements outlined in the national standards and regulations in which the robot is installed.

DAINCUBE Robot Safety Controller users are responsible for ensuring that the safety devices required to comply with the relevant safety laws and regulations of their country and protect people using the robotic system are properly designed and installed.

Robot operators should understand what is described in this safety manual, and be familiar with the operation and handling of industrial robots.

1.1. Introduction

In addition to the built-in safety functions, the robot also has an interface for connecting external safety devices. This interface allows external safety functions to interact with other machines and peripherals. This means that the control signal can act on the safety signal received from the robot as well as the peripheral device.

2. Safety Information

■ Before unpacking and installing the product or adding it to the unit, carefully read all the instructions that come with the package.

■ Do not use the product in extreme dust, humidity or temperature conditions. Do not install the product where it is wet.

■ The power cord must be disconnected before performing assembly and adjustment work or maintenance and inspection of the machine. There is a danger of electric shock.

■ Turn off the power for 5 minutes before servicing the product and wait for longer. Otherwise, residual charge may cause electric shock.

⚠ Warning

■ Please check the grounding before installing and using the product. There is a risk of injury due to electric shock.

■ Use the device within the indicated voltage range.

■ Operators must have more than a certain level of technical knowledge through training and be familiar with the details of the intended use described in the user manual.

■ After installing the product, check the wiring to the main unit again and apply power.

■ When the user (customer) extends wiring, malfunction may occur due to faulty wiring. In this case, inspect wiring thoroughly and check it for properness before turning on the power.

■ Before operating the unit, be sure to check that there is no danger in or around the operating range.

■ Do not allow water or oil to get on the unit and the power cord.

■ Install the unit in a place which can endure its weight and conditions while running.

■ Take care not to squeeze and thus damage the cable with any object.

■ Do not lay the cable over sharp edges to avoid damaging the cable sheath.

■ Check the mounting screws regularly so that they are always firmly tightened.

■ Never touch terminals directly or internal parts of controller.

■ Do not disassemble or modify the product.

■ Before carrying out assembly and adjustment work or maintenance and inspection work of the machine, be sure to disconnect the power cord.

■ Connect the power supply after completing the adjustment of all the cables and switches.

⚠ Caution

■ After the shutdown window, turn off the power supply. Otherwise the components could be destroyed or undefined signals could occur.

■ To prevent the equipment from falling to the ground.

■ Never lay the device onto unstable surfaces. It could fall to ground and thus be damaged.

■ It is recommended to use the unit in an environment where no electrical noise is present.

■ In noisy environments, use a filter fitted.

■ Never lay the device close to heat sources or into direct sunlight.

■ Avoid exposing the device to mechanical vibrations, excessive dust, and humidity or to strong magnetic fields.

■ Make sure that no foreign objects or liquids can penetrate into the device.

■ Wipe the power plug with a clean, dry cloth periodically to eliminate dust.

■ Always pay special attention to the robot's movement in the Manual Mode.

3. Warranty and warranty coverage

DAINCUBE's products are delivered only after passing strict quality inspection before shipment.

3.1. Warranty period

The warranty period is as follows
- 12 months after our shipment.

3.2. Scope of the warranty

Where a defective condition occurs during proper use conditions and obviously under the responsibility of the manufacturer, within the term above, we shall repair the product without charge.

However, any items that apply to the following are excluded from the warranty coverage.

- The warranty is not valid if the defect is due to accidental damage, mishandling, misuse, voltage fluctuation, high/low voltage or natural disaster.
- If the product is repaired or tried to repair from unauthorized personal/Repair Shop.
- If the product serial number is tempered.
- The product is defective due to wear of parts, which can be considered as consumable parts by the nature. (such as a cable)
- Defects resulting from changes over time such as natural color fading of paint.
- Defects resulting from mishandling or improper use.
- Defects resulting from an inadequacy or error in maintenance and inspection.
- Defects resulting from the use of any part other than our genuine parts.
- Defects resulting from a modification not approved by us or our dealers.

Only a delivered product shall be singly warranted, and no damage induced by the defect of the delivery product can be warranted. For repair, transport the product to our factory.

3.3. Service coverage

The cost of a delivered product does not include expenses for program creation and engineer dispatching. Therefore, the following are charged separately even within the warranty term:

- Maintenance and inspection.
- Technical guidance and technical training in the operating instructions.
- Technical guidance and technical training on program-related matters such as program creation.

4. Product Description

4.1. Specification
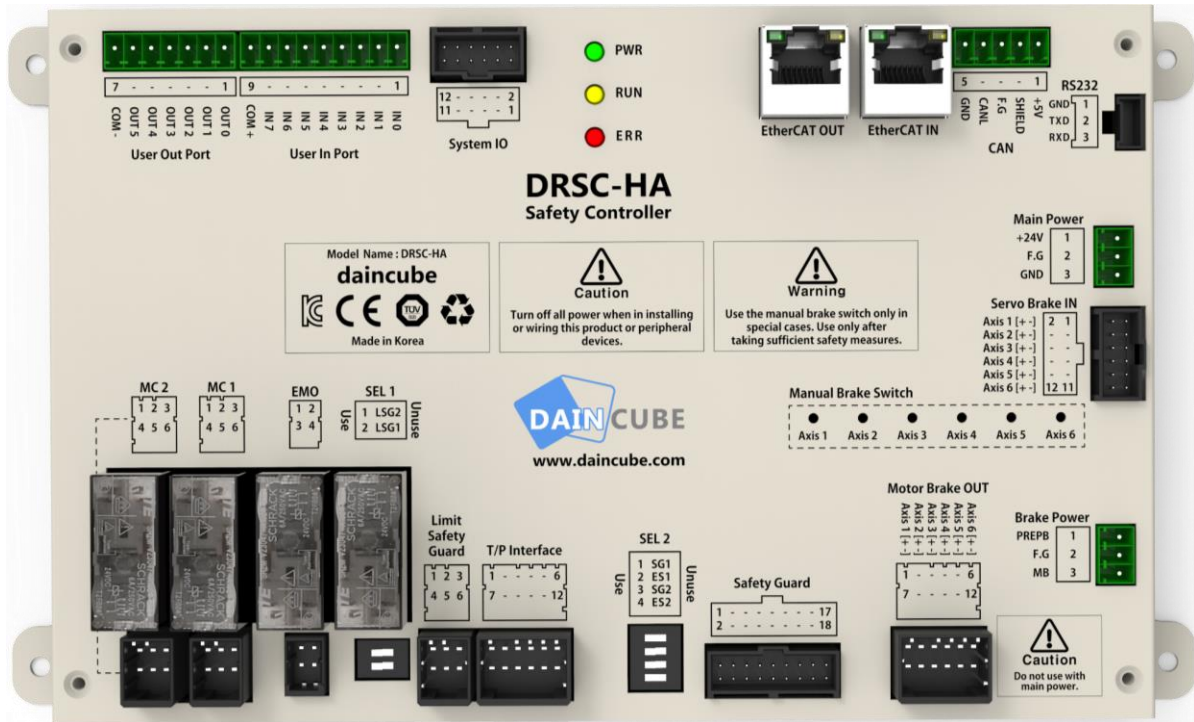
- DRSC-HA in the robot control box is a safety controller optimized and configured for industrial robots and automation equipment. It satisfies ISO 13849-1 and ISO 10218-1 which ensure that the safety regulation for robots.
- It has emergency stop system, dual safety channel, safety state monitoring, internal/external brake control and monitoring function and EtherCAT communication that apply to various fields.

| Function specification		
International standard design		ISO 13849-1, 10218-1 Robot safety compliance
Safety Channel	**Input**	Dual emergency switch
		Dual enabling switch
		Dual safety guards input, Dual external safety guards input
		Dual limit / over voltage Input
		Operation mode switch
	Output	Safety outputs (MCs & EMGs)
General	**Input**	System input(4) (Motor power on/Run/Error clear switch)
		User input (8) (EtherCAT I/O)
	Output	System output(4) (Motor power on/Run/Error lamp)
		User output (6) (EtherCAT I/O)
Monitoring		Safety channel status phase monitoring
		Status output via LED
		Error status transmitted to controller
Brake Control		Internal / External brake control
		Periodic brake monitoring
Communication	**EtherCAT**	ESC (EtherCAT Slave Controller)
	CAN	1Mbps (Optional)
	RS-232	115200bps (Optional)

Hardware specification		
CPU		ARM Cortex-M3 (120MHz)
Memory	**FLASH**	1MB
	SRAM	128KB
Operating	**Voltage**	DC24V
	Current	500mA max.
Input	**ON voltage**	11V min
	ON current	10mA min
	OFF voltage	5V min
	OFF current	1mA max.
Output	**ON-state residual**	3.0V max.
	OFF-state leakage	0.1mA max.
Operating time (OFF to ON State)		50ms max. (Safety input: ON)
		100ms max. (Logical AND connection input: ON)
Response time (ON to OFF state)		15ms max.
Accuracy of OFF-delay time		Within ±5% of the set value
Ambient operating humidity		25% ~ 85%
Ambient operating temperature		0 ~ 45℃

4.2. Mounting method

■ **Case appearance(dimension)**
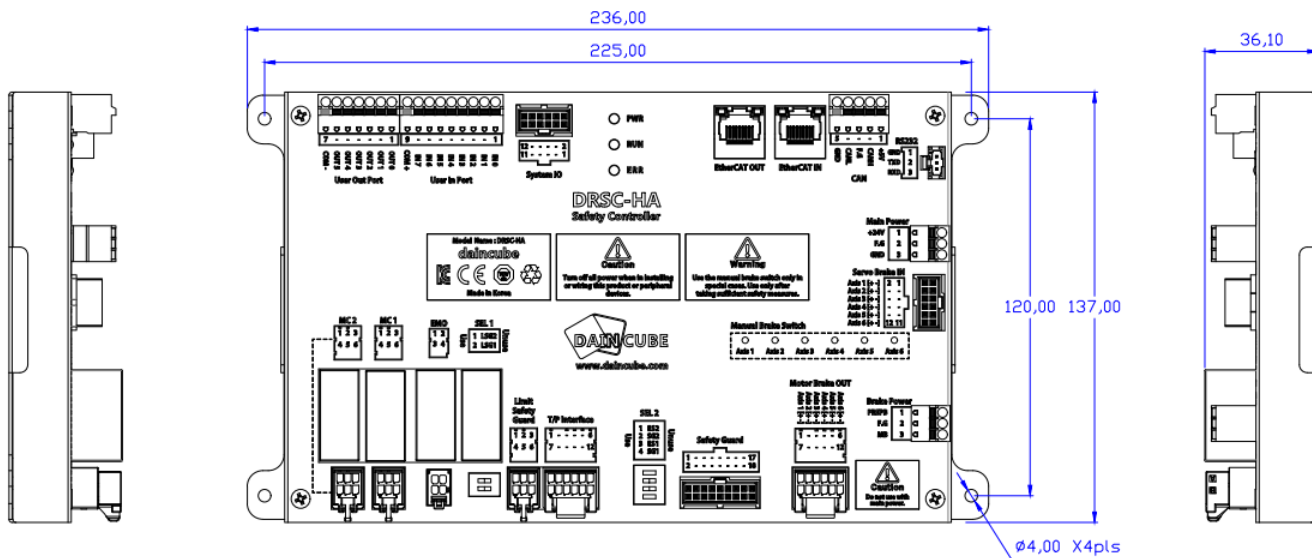
■ **If using without case**

- If using the case, refer to above dimension information.
- Space around the controller for ventilation and wiring.
- If not using the case, refer to below dimension information.
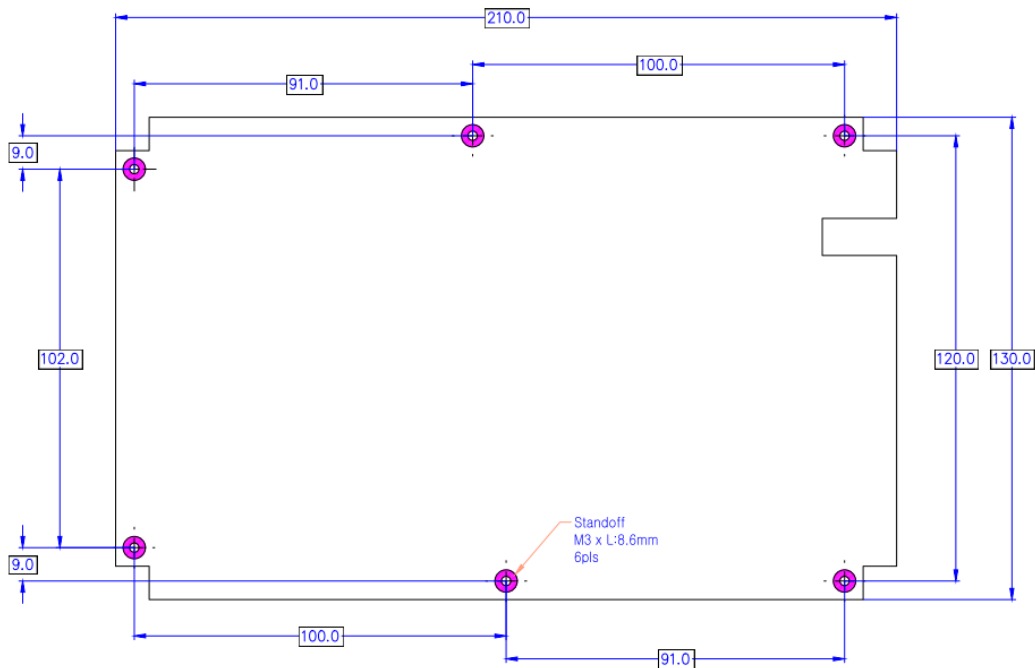
4.3. Overall configuration
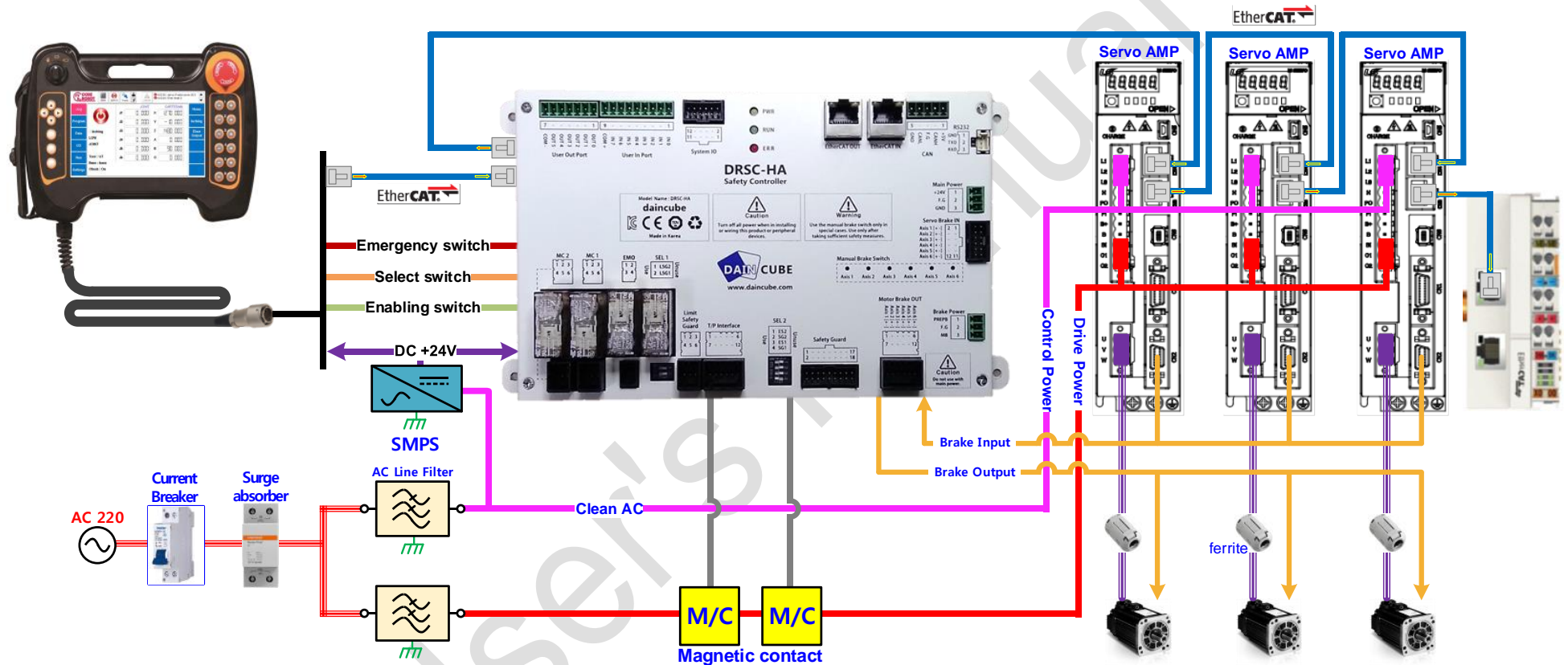
4.4. Functional diagram
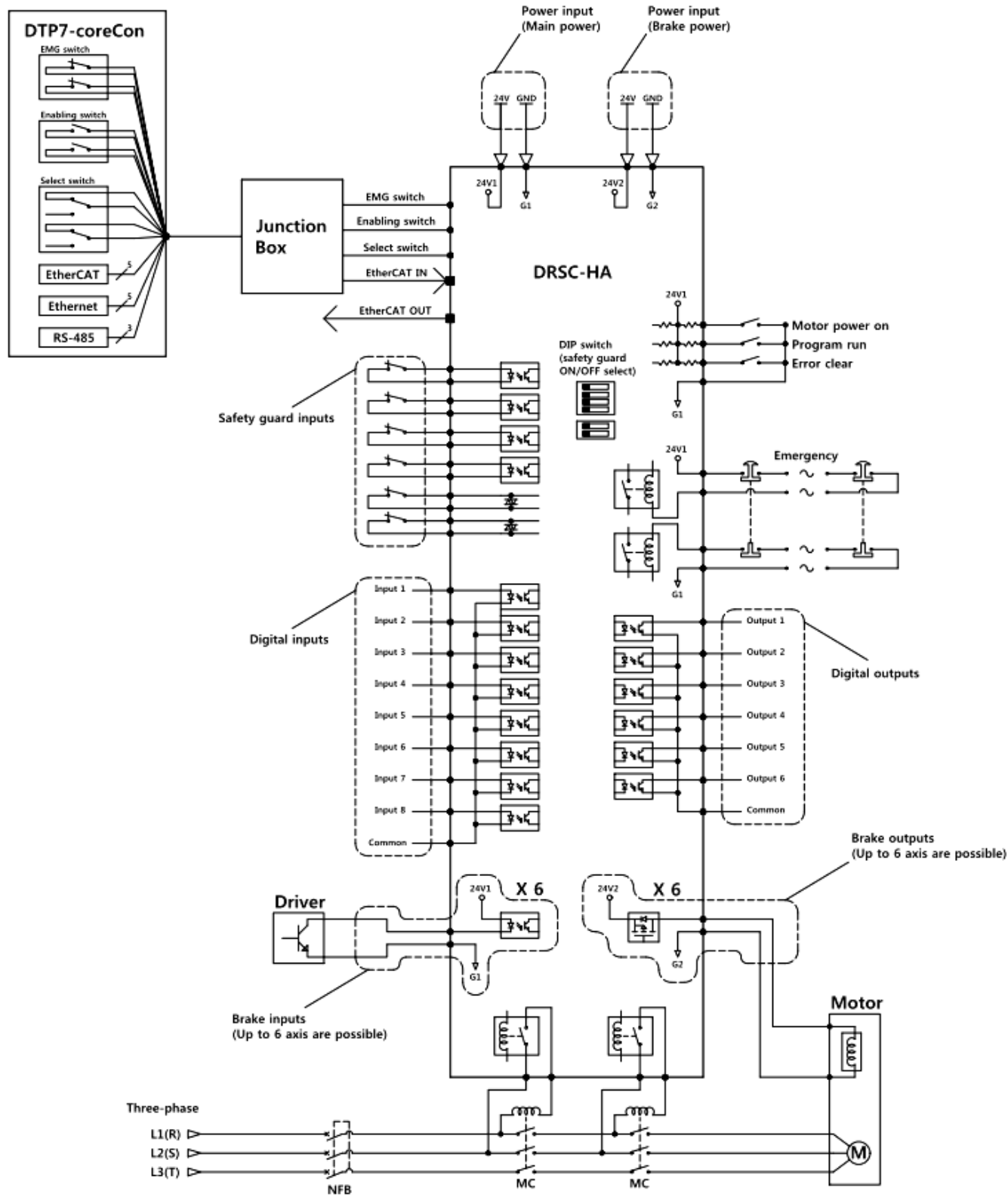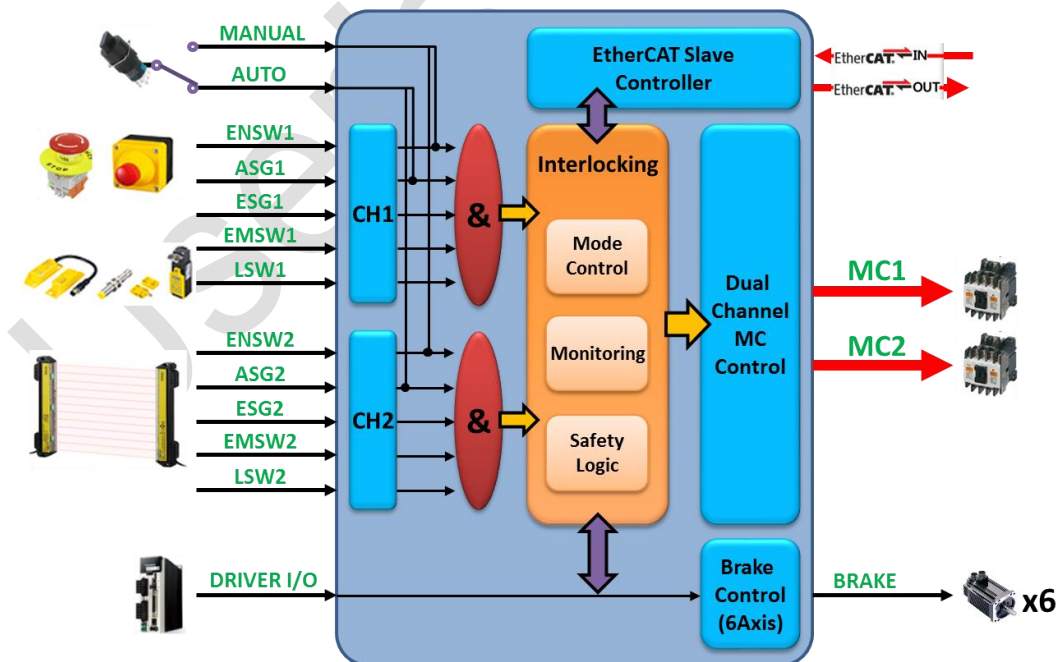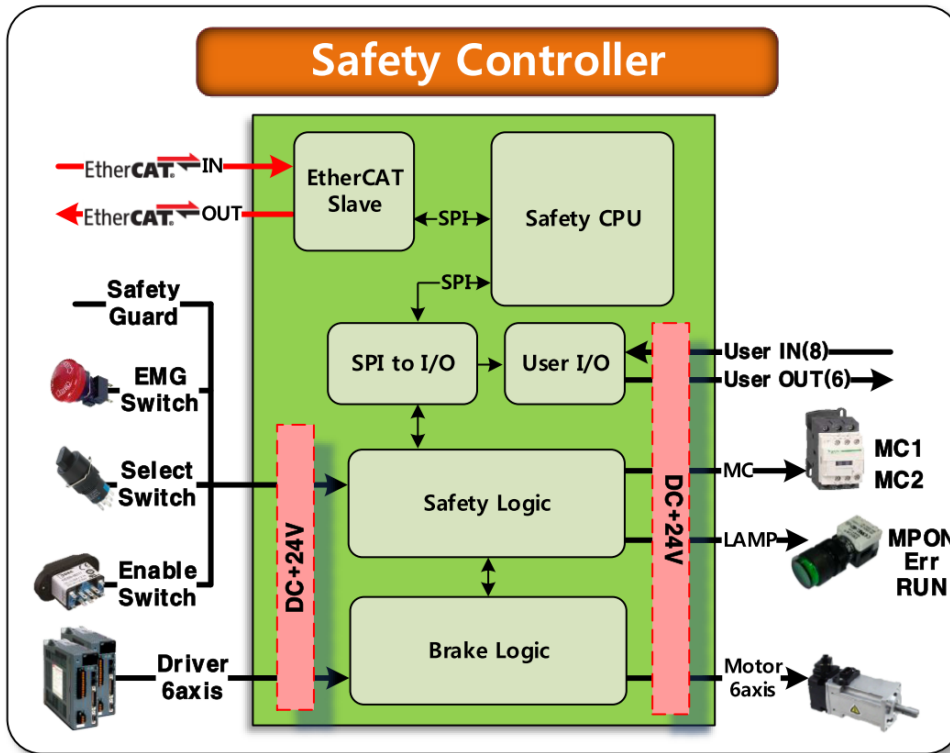
4.5. Operation sequence
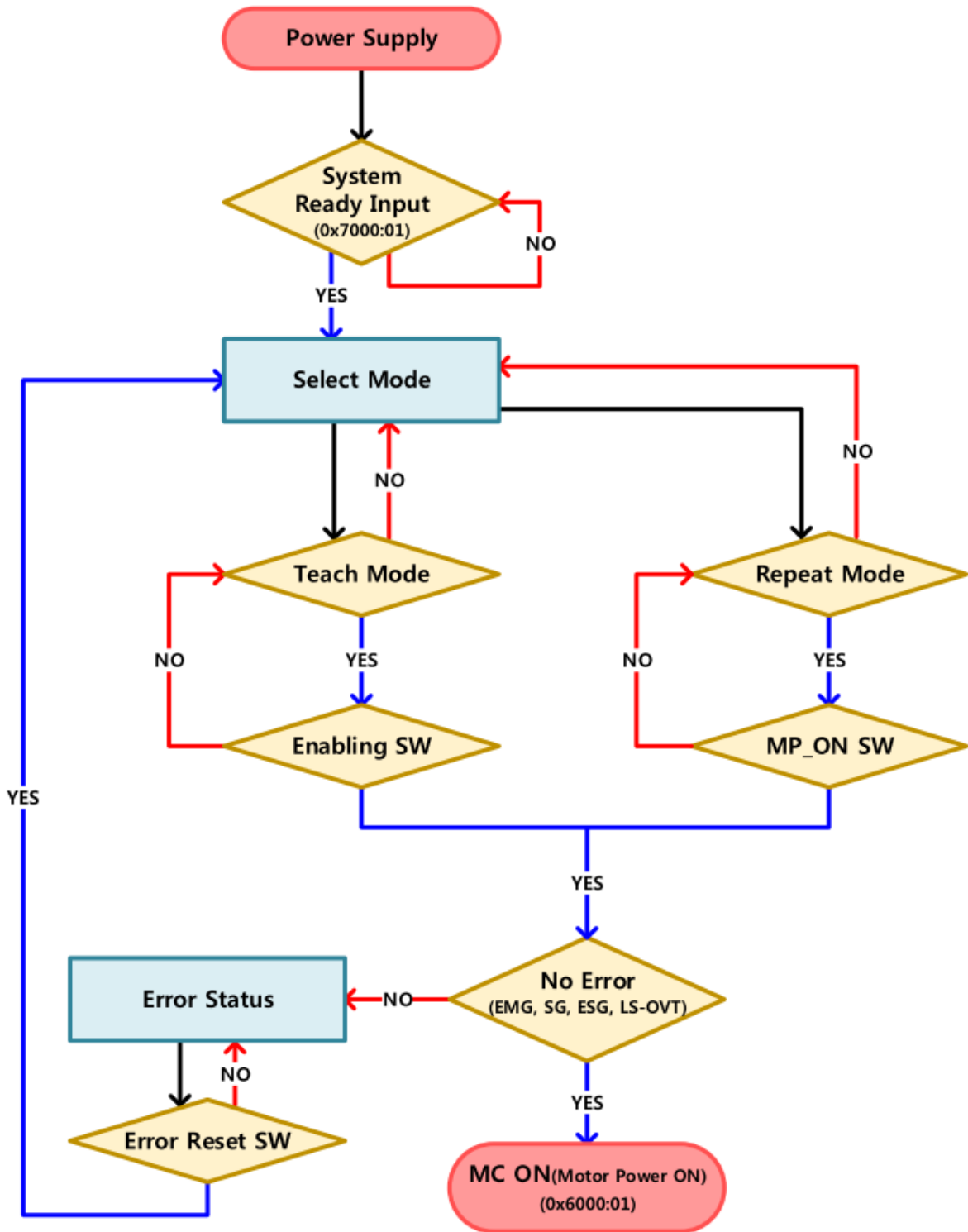
4.6. Operation timing

Parameter	Symbol	MIN	MAX	Unit
MC ON Delay Time	tMCOND	-	2	ms
MC OFF Delay Time	tMCOFFD	700	-	ms

■ **Manual Mode**
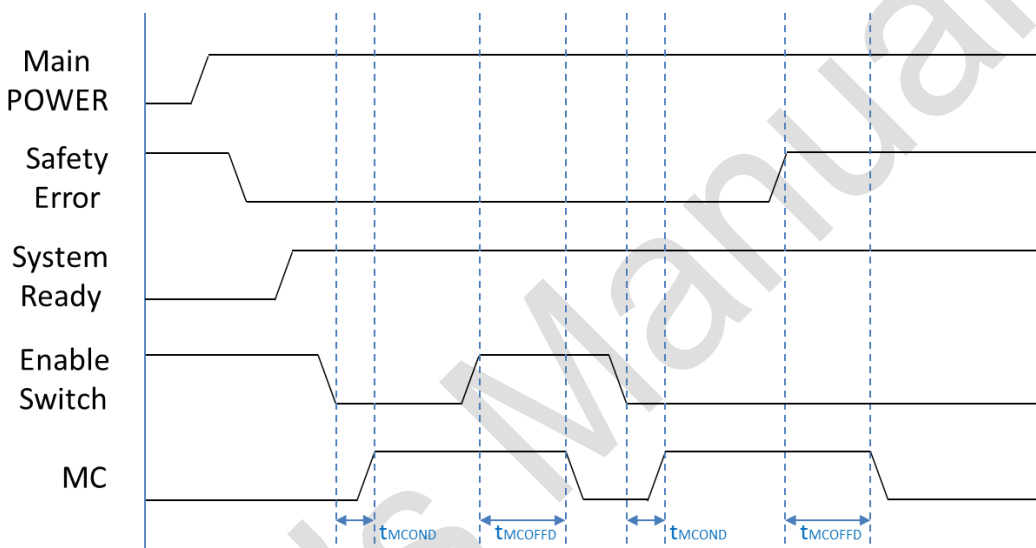
■ **Auto Mode**
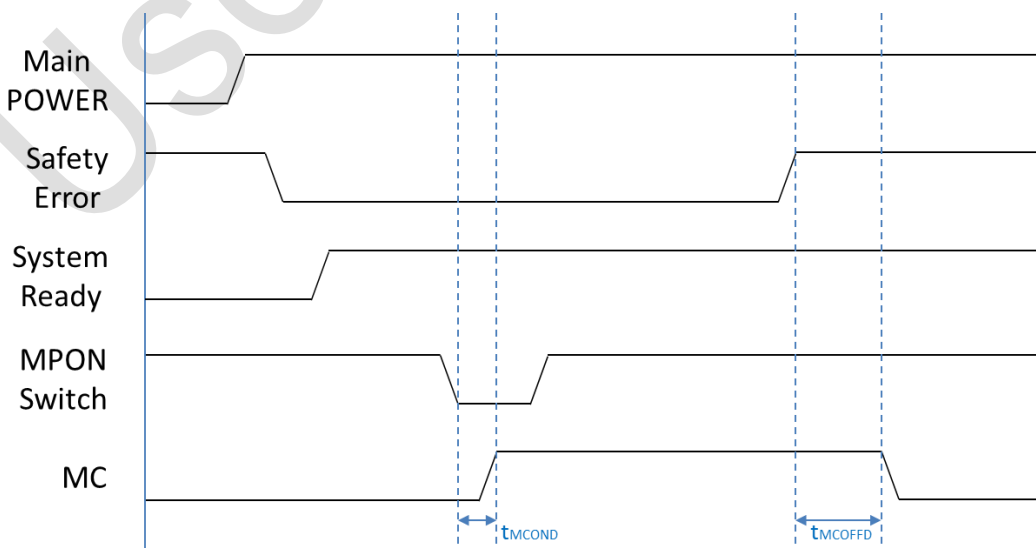
4.7. Signal name

■ **Mode and safety signal names**

Name	Signals	Sel1	Sel2	Descriptions
Mode	REMOTE	Off	On	AUTO mode
	AUTO	On	On	
	MAN	On	Off	Manual Mode
Safety Signals	EN SW	EN1		Enabling Switch (Available in Manual mode)
		EN2		
	ASG	ASG1		AUTO mode Safe Guard
		ASG2		
	ESG	ESG1		External Safe Guard
		ESG2		
	EMG_IN	TP_EMG1		Emergency SW in Teach Pendant
		TP_EMG2		
		OP_EMG1		Emergency SW in Operation Panel
		OP_EMG2		
	EMG_OUT	EMG_OUT1		Emergency Output
		EMG_OUT2		
	LS-OVT	LS-OVT1		Limit or OVT Signal in Robot Body
		LS-OVT2		
Command	CMD_MPON	CMD_MPON1		Motor Power On Command
		CMD_MPON2		
	Sub_CMD	Sub_CMD1		Sub_Command for Control
		Sub_CMD2		

■ **Brake signal name specification**

Name	Signals	Function	Description	Remarks
Brake	ExBRK_IN1	BRK1	Brake 1 On/Off FET Output(2A)	External Input
	BRK_IN1			Internal Input
	BRK_MN1			Manual Input
	ExBRK_IN2	BRK2	Brake 2 On/Off FET Output(2A)	"
	BRK_IN2			
	BRK_MN2			
	ExBRK_IN3	BRK3	Brake 3 On/Off FET Output(2A)	"
	BRK_IN3			
	BRK_MN3			
	ExBRK_IN4	BRK4	Brake 4 On/Off FET Output(2A)	"
	BRK_IN4			
	BRK_MN4			
	ExBRK_IN5	BRK5	Brake 5 On/Off FET Output(2A)	"
	BRK_IN5			
	BRK_MN5			
	ExBRK_IN6	BRK6	Brake 6 On/Off FET Output(2A)	"
	BRK_IN6			
	BRK_MN6			

■ **I/O signal name specification**

Name	Signals	Function	Description
System I/O	System IN1	MP_ON SW	Motor Power ON Switch
	System IN2	RUN_SW	RUN Switch
	System IN3	RESET	Error Reset Switch
	System IN4	Spare1	Spare for future
	System OUT1	MP_ON_LAMP	Motor Power ON Lamp
	System OUT2	RUN_LAMP	RUN Lamp
	System OUT3	ERR_LAMP	Error Lamp
	System OUT4	Robot_LAMP(*)	Robot용 Lamp(UL대응)
User Inputs	User IN1	User	User Input 1
	User IN2	User	User Input 2
	User IN3	User	User Input 3
	User IN4	User	User Input 4
	User IN5	User	User Input 5
	User IN6	User	User Input 6
	User IN7	User	User Input 7
	User IN8	User	User Input 8
User Outputs	User OUT1	User	User Output 1
	User OUT2	User	User Output 2
	User OUT3	User	User Output 3
	User OUT4	User	User Output 4
	User OUT5	User	User Output 5
	User OUT6	User	User Output 6

5. EtherCAT

5.1. Process Data Object

	Sender	Receiver
RxPDO (1600h, sm2)	Master	Slave
TxPDO (1A00h, sm3)	Slave	Master

■ **RxPdo (Master -> Slave)**

Index	Sub-Index	Bit-Length	Bit Position	Name
7000h	1	8	0	System Ready
			1	External Error Signal
			2	High Speed State
			3	Program Running State
			4	Reserved
			5	Reserved
			6	Reserved
			7	External Motor Power ON
	2	8	0	Reserved
			1	Reserved
			2	Reserved
			3	Reserved
			4	Reserved
			5	Reserved
			6	Reserved
			7	Reserved
	3	8	0	User Output 1
			1	User Output 2
			2	User Output 3
			3	User Output 4
			4	User Output 5
			5	User Output 6
			6	Reserved
			7	Reserved
	4	8	0	Reserved
			1	Reserved
			2	Reserved
			3	Reserved
			4	Reserved
			5	Reserved
			6	Reserved
			7	Reserved

• Signal for operation of DRSC-HA. Be careful because there are signals that must be set as required.

Sub-Index	Bit Position	Name	Description
1	0	**System Ready**	**Ready signal for DRSC-HA. (When it is High, it works normally.) - Required**
	1	External Error Signal	This signal informs DRSC-HA of external error status. DRSC-HA detects external error and performs Motor Power Off.
	2	High Speed State	It is a signal to give a sufficient deceleration time before shutting off power when using high load equipment / robot. Please contact us for details.
	3	Program Running State	This signal lights the lamp of the external operation switch (RUN) connected to DRSC-HA.
	8	External Motor Power ON	Motor Power ON method by external signal. When signal is applied to the corresponding bit, Motor Power ON operation is performed in Auto mode.

■ **TxPdo (Slave -> Master)**

Index	Sub-Index	BitLen	Bit Position	Name
6000h	1	8	0	Motor Power ON
			1	Mode Switch 1 (Manual)
			2	Mode Switch 2 (Auto)
			3	Enabling Switch
			4	Error Clear
			5	Program Start
			6	Emergency Switch
			7	Safety Error State
	2	8	0	Magnetic Contact 1
			1	Auto Safety Guard 1
			2	External Safety Guard 1
			3	Limit Safety Guard 1
			4	Safety Chain 1
			5	Emergency TP 1
			6	Emergency OP 1
			7	Reserved
	3	8	0	User Input 1
			1	User Input 2
			2	User Input 3
			3	User Input 4
			4	User Input 5
			5	User Input 6
			6	User Input 7
			7	User Input 8
	4	8	0	Magnetic Contact 2
			1	Auto Safety Guard 2
			2	External Safety Guard 2
			3	Limit Safety Guard 2
			4	Safety Chain 2
			5	Emergency TP 2
			6	Emergency OP 2
			7	Reserved

- This is the signal that the controller can monitor the status of DRSC-HA.

Sub-Index	Bit Position	Name	Description			
1	0	Motor Power ON	High. If motor power is on.			
				Manual Mode		Auto Mode
	1	Mode Switch 1 (Manual)		High		Low
	2	Mode Switch 2 (Auto)		Low		High
	3	Enabling Switch	High. If the A contact signal of the enabling switch is applied.			
	4	Error Clear	High. If the A contact signal of external operation switch (ERR) is applied.			
	5	Program Start	High. If the A contact signal of external operation switch (RUN) is applied.			
	6	Emergency Switch	High. If B contact signal of emergency stop switch is applied. (Default: High)			
	7	Safety Error State	High. In all error status of DRSC-HA.			
2	0	Magnetic Contact 1	High. If Magnetic contact 1 is on.			
			Normal	SG1 error	ES1 error	LS1 error
	1	Auto Safety Guard 1	High	Low	High	High
	2	External Safety Guard 1	High	Low	Low	High
	3	Limit Safety Guard 1	High	High	High	Low
	4	Safety Chain 1	High	Low	Low	High
			Auto Safety Guard 1 : High. If the B contact signal of the SG 1 is applied. External Safety Guard 1 : High. If the B contact signal of the ES 1 is applied. Limit Safety Guard 1 : High. If the B contact signal of the LS 1 is applied. Safety Chain 1 : High. If Safety Chain 1 is normal.			
	5	Emergency TP 1	High. If B contact signal of emergency stop switch (in T/P) is applied. (Default: High)			
	6	Emergency OP 1	High. If B contact signal of emergency stop switch (connected to DRSC-HA) is applied. (Default: High)			
4	0	Magnetic Contact 2	High. If Magnetic contact 2 is on.			
			Normal	SG2 error	ES2 error	LS2 error
	1	Auto Safety Guard 2	High	Low	High	High
	2	External Safety Guard 2	High	Low	Low	High
	3	Limit Safety Guard 2	High	High	High	Low
	4	Safety Chain 2	High	Low	Low	High
			Auto Safety Guard 2 : High. If the B contact signal of the SG 2 is applied. External Safety Guard 2 : High. If the B contact signal of the ES 2 is applied. Limit Safety Guard 2 : High. If the B contact signal of the LS 2 is applied. Safety Chain 2 : High. If Safety Chain 1 is normal.			
	5	Emergency TP 2	High. If B contact signal of emergency stop switch (in T/P) is applied. (Default: High)			
	6	Emergency OP 2	High. If B contact signal of emergency stop switch (connected to DRSC-HA) is applied. (Default: High)			

※ Reference

- Method to connect the enabling switch : [Contents 7.4 T/P Interface]
- Method to connect the emergency stop switch : [Contents 7.3 EMO], [Contents 7.4 T/P Interface]
- Method to connect the external operation switch : [Contents 7.2 System IO]

6. DRSC setting using coreCon

This section describes how to set up System I / O for the DRSC-HA using the DINECUBE controller DTP7-coreCon.

6.1. System I / O map of DRSC

Name	Mapping No
System Output	
DDCO_SYSTEM_READY	1
DDCO_ERROR	2
DDCO_HIGH_SPEED	3
DDCO_RUN1	4
DDCO_REPEAT (Depend on user)	8
System Input	
DDCI_MOTOR_POWER_ON	1001
DDCI_SELECT1	1002
DDCI_SELECT2	1003
DDCI_TPENABLE	1004
DDCI_ERESET	1005
DDCI_PROGRAM_START	1006
DDCI_EMSTOP	1007
DDCI_SAFETY_ERROR	1008

6.2. Precautions for System I / O Setting

① **If DRSC is connected first among EtherCAT I / O**

 • System I / O registration according to the I / O mapping number written in the manual.

② **If DRSC is not connected first among EtherCAT I / O**

  • Add EtherCAT I / O number connected before DRSC to system I / O

    * **Example)** Output-8, Input-8 When I / O is connected before DRSC

	In case of ①	In case of ②(*Example)
Name	**Mapping No.**	
System Output		
DDCO_SYSTEM_READY	1	9
DDCO_ERROR	2	10
DDCO_HIGH_SPEED	3	11
DDCO_RUN1	4	12
DDCO_REPEAT (Depend on user)	8	16
System Input		
DDCI_MOTOR_POWER_ON	1001	1009
DDCI_SELECT1	1002	1010
DDCI_SELECT2	1003	1011
DDCI_TPENABLE	1004	1012
DDCI_ERESET	1005	1013
DDCI_PROGRAM_START	1006	1014
DDCI_EMSTOP	1007	1015
DDCI_SAFETY_ERROR	1008	1016

6.3. How to System I/O Setting
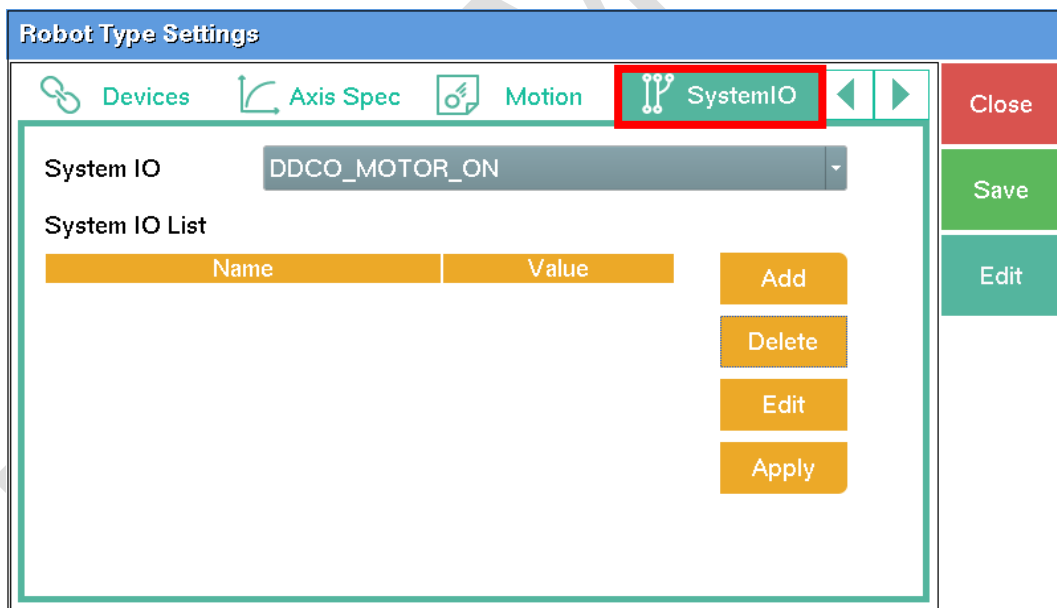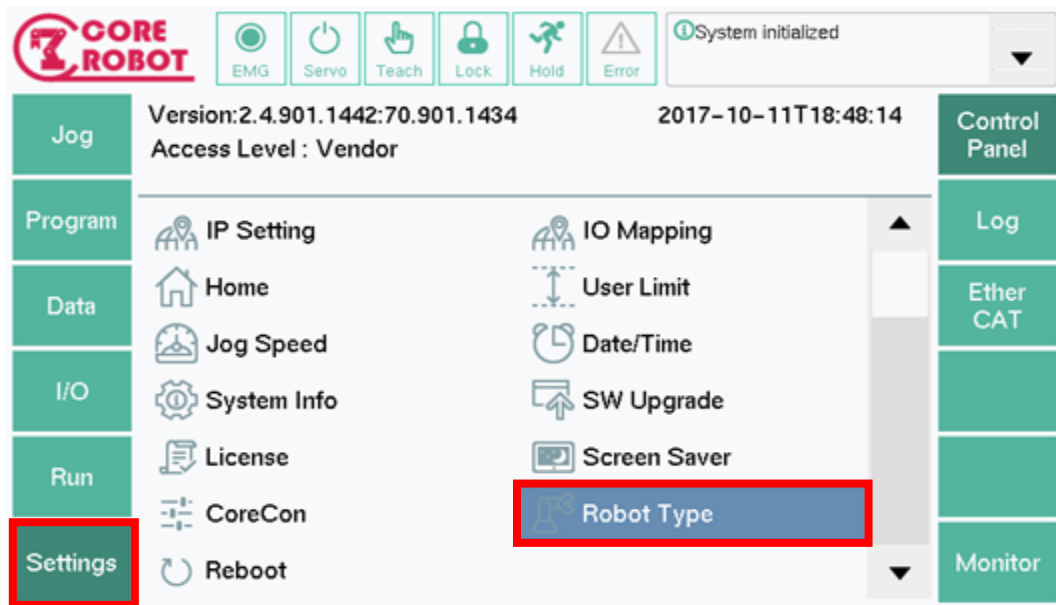
- Follow the menus shown in the figure to access the System I / O Setting menu.
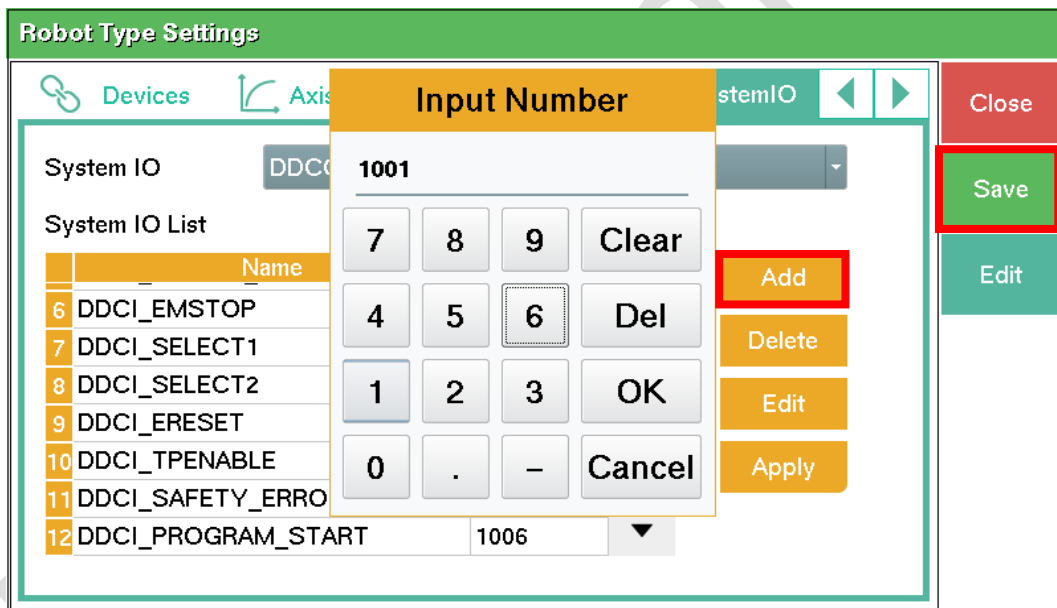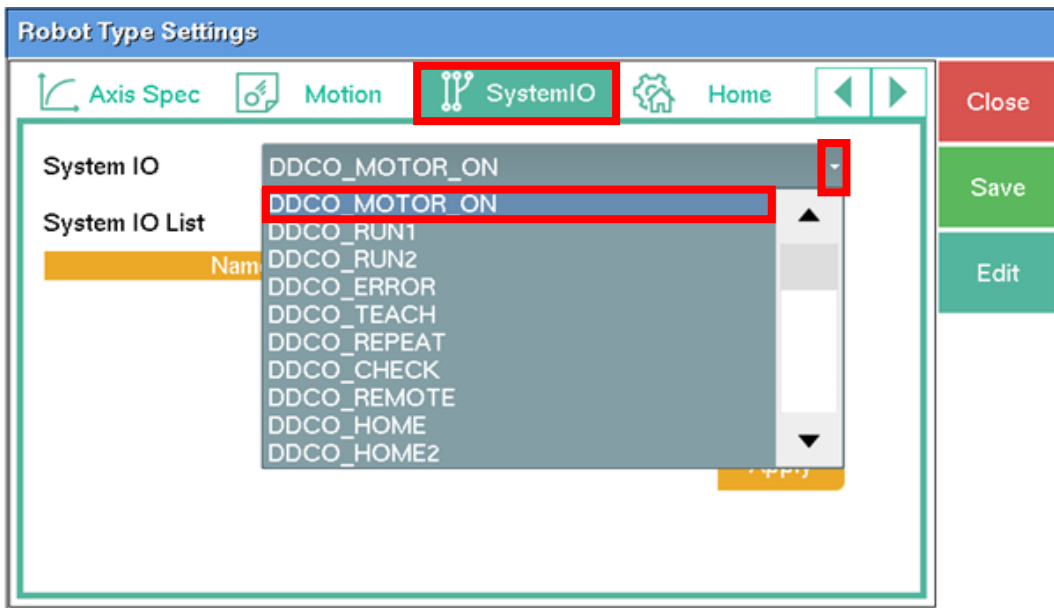
- Select the System I / O you want to use and press the Add button to enter the assigned I / O number.
- After completing the System I / O Setting and pressing the Save button, the reboot will start automatically.

6.4. System I/O Monitoring
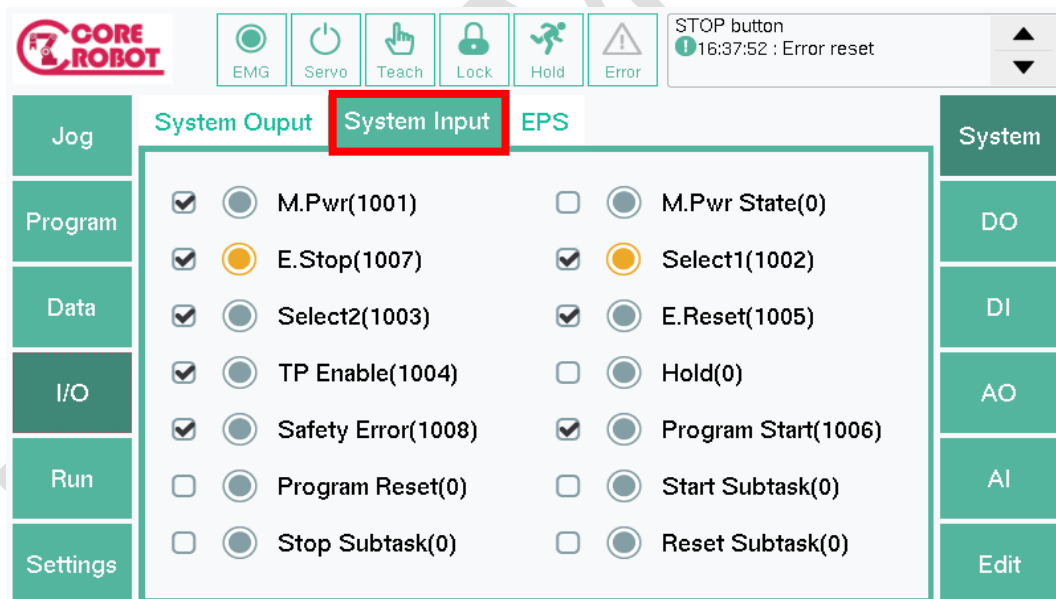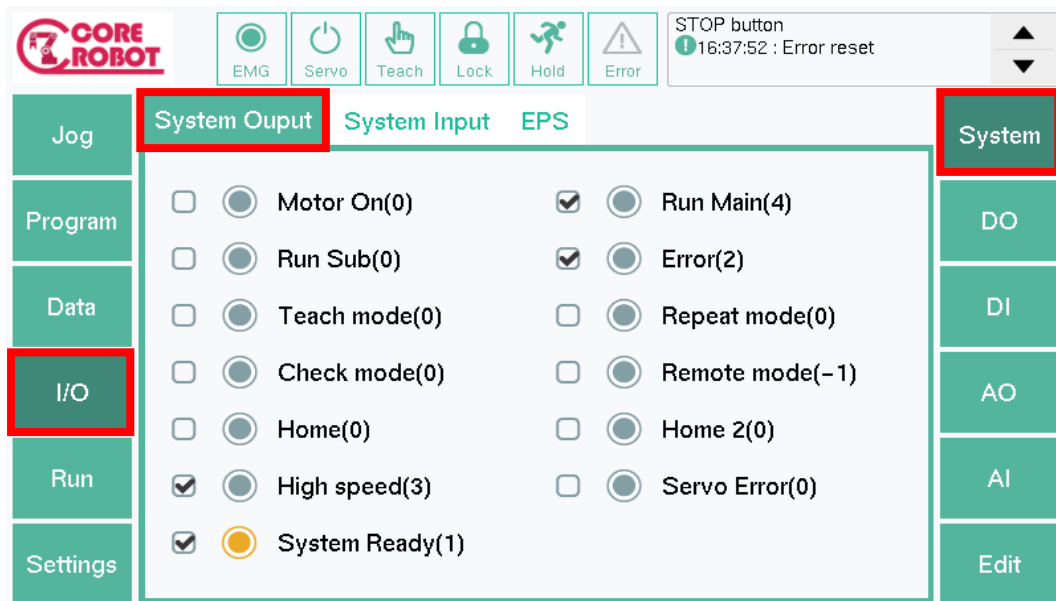
• Check that the System I / O is properly registered through the menu shown in the figure.

6.5. How to Motor Power On

There are three Motor Power On methods using DRSC-HA provided by DAINCUBE controller.

No.	Mode	How
1	Manual Mode	Push Enabling Switch on Teach Pendant
2	Auto Mode	Apply the input to the MP_ON SW terminal of the DRSC
3		DRSC Outputs the signal at Output-8
* No.3 – If you want to use Ext Motor Power ON via external signal		
Ex) If registering DDCO_REPEAT=8 in System I/O, Motor Power ON when it is in Auto Mode		

7. Wiring to connector
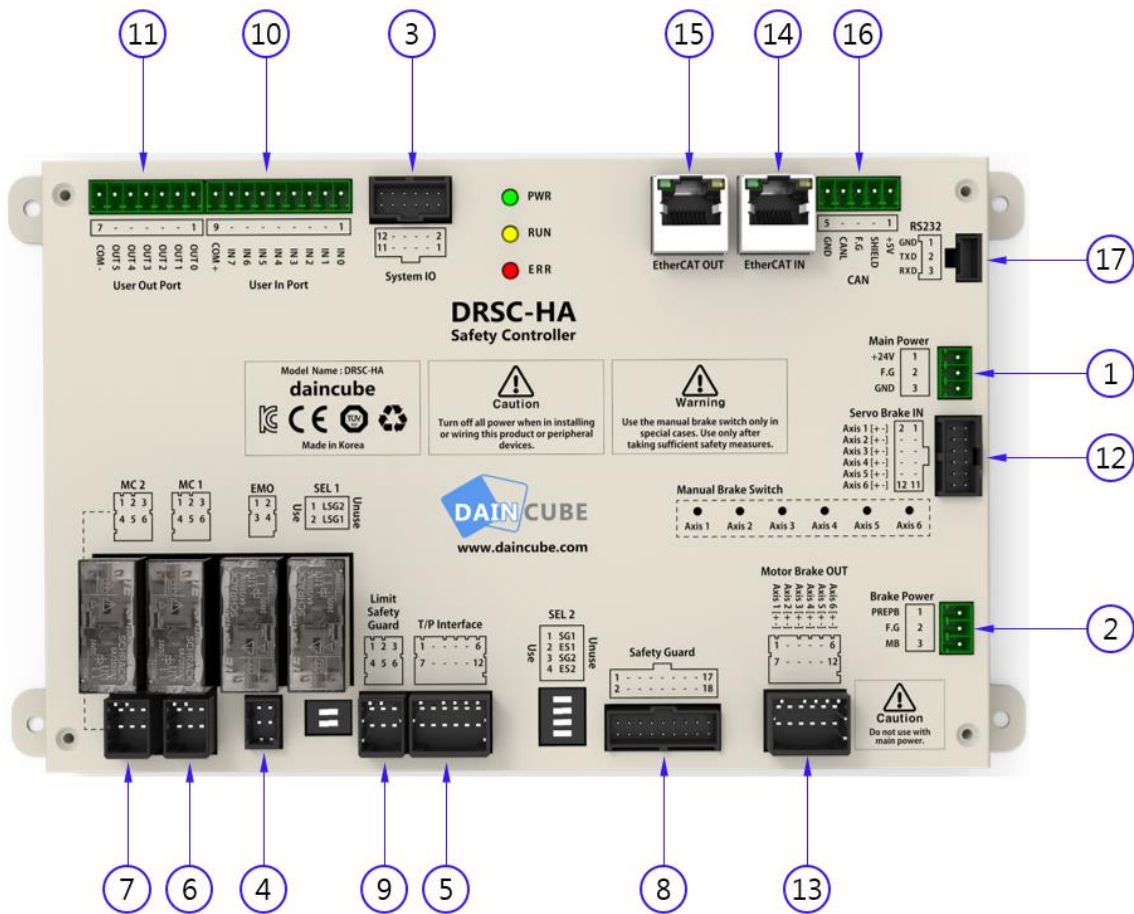
No	Connector	Description	Reference
1	Main Power	Main power input (DC24V)	Contents 7.1, 8.2
2	Brake Power	Motor Brake power input (DC24V)	Contents 7.1, 8.2
3	System IO	Motor power on/Program run/Error clear switch input	Contents 7.2, 8.3
4	EMO	Emergency switch input	Contents 7.3, 8.4
5	T/P Interface	Teach pendant interface	Contents 7.4, 8.5
6	MC1	Magnetic contactor control	Contents 7.5, 8.6
7	MC2	Magnetic contactor control	Contents 7.5, 8.6
8	Safety Guard	Safety guard signal input	Contents 7.6, 8.7
9	Limit Safety Guard	Safety guard signal input	Contents 7.7, 8.8
10	User In Port	User digital I/O (NPN)	Contents 7.8, 8.9
11	User Out Port	User digital I/O (NPN)	Contents 7.8, 8.9
12	Servo Break IN	Brake control signal input	Contents 7.9, 8.10
13	Motor Brake OUT	Brake power output	Contents 7.9, 8.10
14	EtherCAT IN	EtherCAT communication input	Contents 8.11
15	EtherCAT OUT	EtherCAT communication output	Contents 8.11
16	CAN	Debug port	Contents 8.12
17	RS232	Debug port	Contents 8.13

7.1. Power
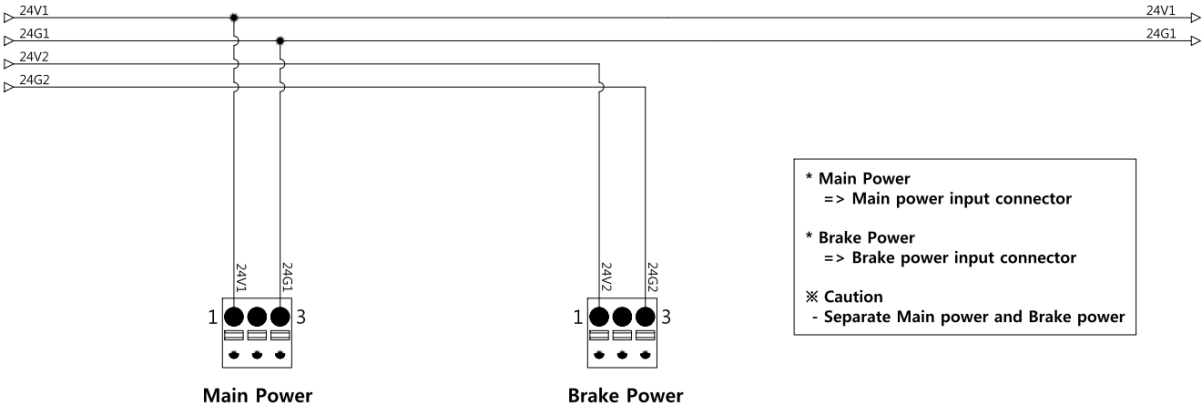
- DRSC-HA has main power and motor brake power.
- Disconnect both power sources to prevent noise from the brake coil
- Select the cable that meets the motor brake current specification for the motor brake power

7.2. System IO

- For user's convenience, it provides input pin that performs Motor power on, Program run and Error clear function. It is usually used by connecting A contact switch.
- It also provides output pin (24VDC) for Motor power on, Program run and Error status.

- Refer to the table below for a description of each input/output.

구분	항목	설명
Input	Motor power on	Magnetic contactor is turned on (under auto mode)
	Program run	Send program run signal to controller (under auto mode)
	Error clear	Clear the error state of the controller when there is no error
Output	Motor power on	The lamp lights when the magnetic contactor is turned on
	Program run	The lamp lights when the controller's program is run (under auto mode)
	Error	The lamp lights when an error occurs, and off when error clear

7.3. EMO (Emergency switch)
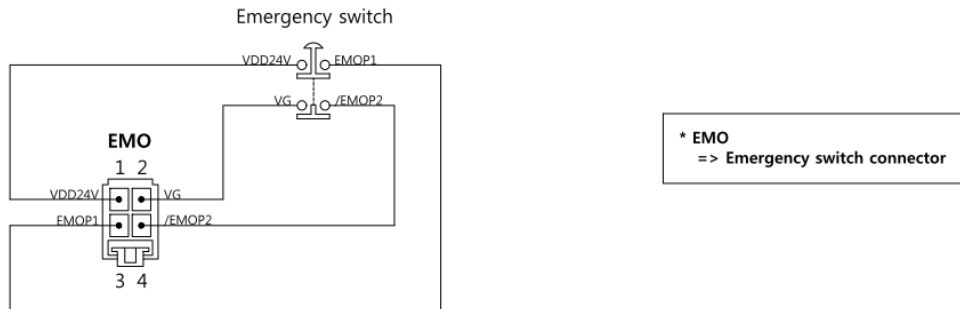
- Provides an additional Emergency switch connection in addition to the Teach Pendant Emergency switch.
- Emergency switch must has 2B contact.
- **It is necessary to make connection for the use of the product.** When not using Emergency switch, pins 1-3, 2-4 should be shorted.

7.4. T/P Interface

■ **If using DAINCUBE's controller (DTP7-coreCon and Junction Box)**
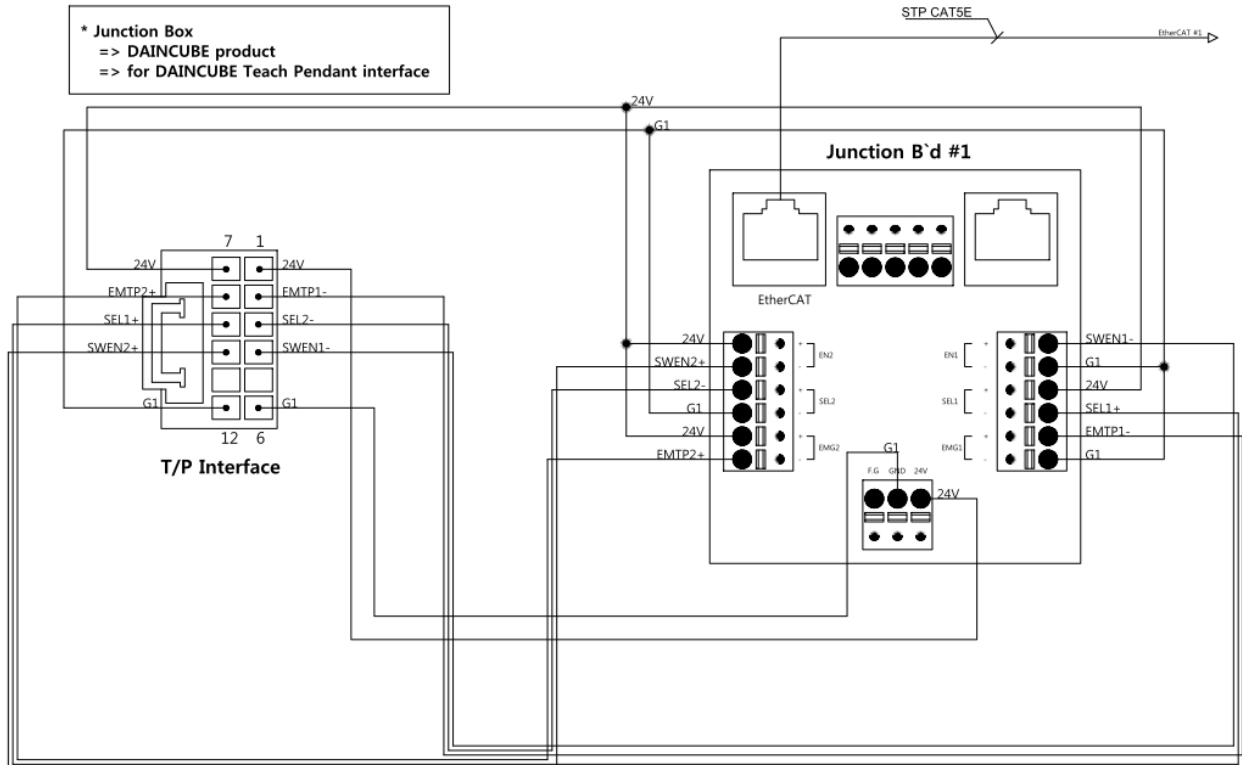
• Teach Pendant safety switch (Emergency / Enabling / Select switch) can be connected.

• Safety PLC Logic is implemented as H / W, so safety logic can be applied by connecting the safety switch with cable.

• By using the Junction box supplied by DAINCUBE, you can easily connect the safety switch and EtherCAT communication of DAINCUBE's controller with DRSC-HA.

• Especially, **Emergency switch must be connected for the use of the product**, and if Emergency switch is not used, pins 7-8 and 2-12 should be shorted.

■ **If using other Teach pendant**
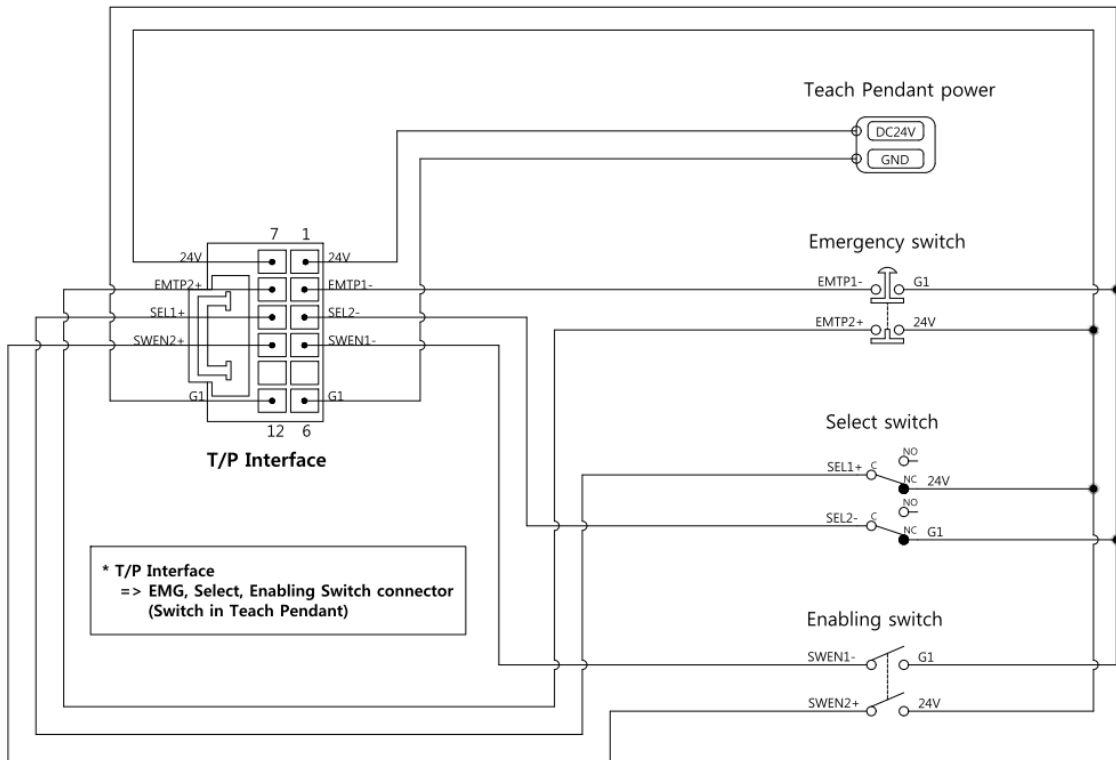
• Teach Pendant safety switch (Emergency / Enabling / Select switch) can be connected.

• Safety PLC Logic is implemented as H / W, so safety logic can be applied by connecting the safety switch with cable.

• Emergency switch 는 2B 접점을 사용해야 합니다.

• Especially, **Emergency switch must be connected for the use of the product**, and if Emergency switch is not used, pins 7-8 and 2-12 should be shorted.

7.5. MC 1/2 (Magnetic contactor)

■ **If using Magnetic contactor (<u>built-in DC24V coil</u>)**
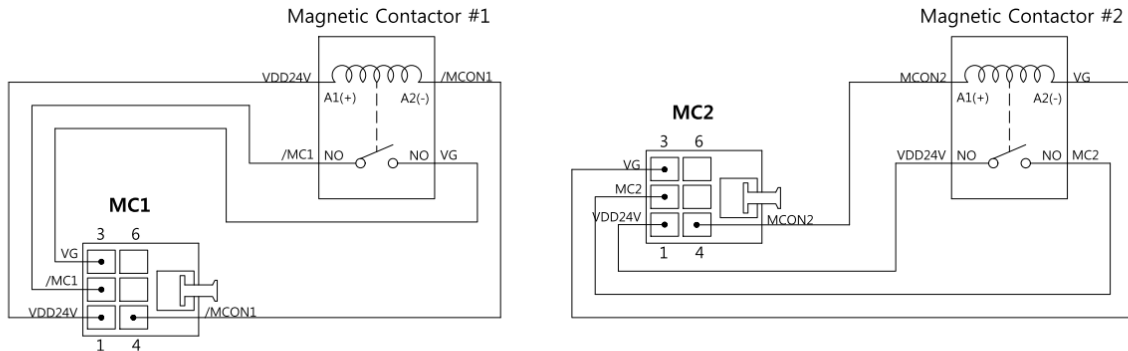
* DRSC-HA outputs its own power to control magnetic contactor ON / OFF when DC24V coil is used.
* It has a built-in freewheeling diode for safe operation.
* User can check the status of MC by using auxiliary contact of MC.

■ **If using Magnetic contactor (<u>built-in other than DC24V coil</u>)**
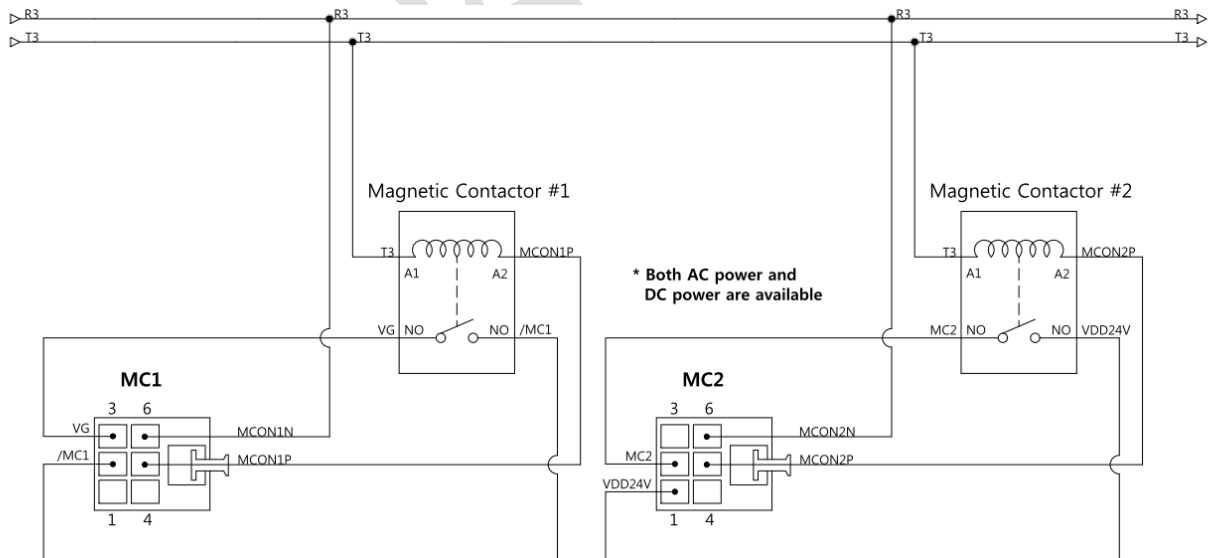
* For magnetic contactor (built-in other than DC24V coil), it can be controlled by using relay contacts inside DRSC-HA.
* It is recommended to connect a freewheeling diode to the coil for magnetic contactor's life and safety.
* User can check the status of MC by using auxiliary contact of MC.
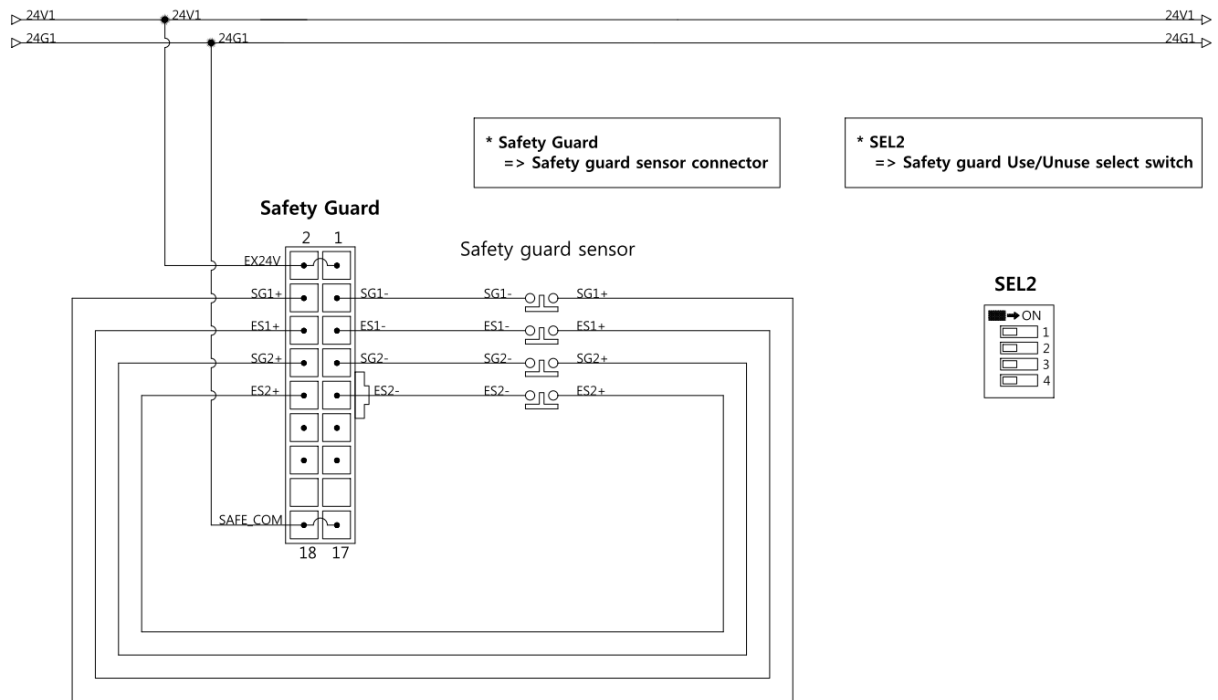
7.6. Safety Guard

- It provides four safety guard input pins, such as light curtain and safety door switch. It must be connected to B contact.
- If not using the safety guard, position the 'SEL2' switch in the ON direction.
- **Regardless of whether or not the safety guard is used, the <u>power for the safety guard must be connected in order to use the product</u>**

7.7. Limit Safety Guard
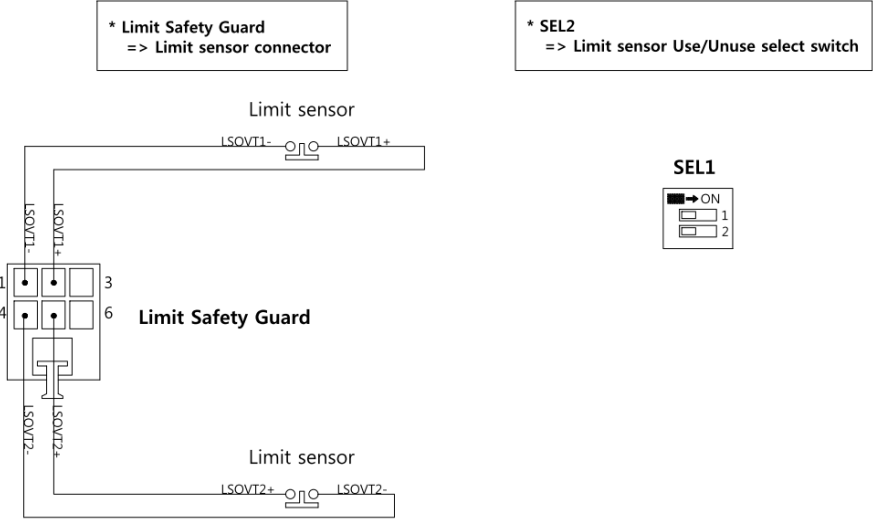
- • It provides two limit safety guard input pins, such as limit sensor. It must be connected to B contact.
- • If not using the limit safety guard, position the 'SEL1' switch in the ON direction

7.8. User In/Out Port

* User In Port
  => Digital Input(8point) connector

* User Out Port
  => Digital Output(6point) connector

User In Port

User Out Port
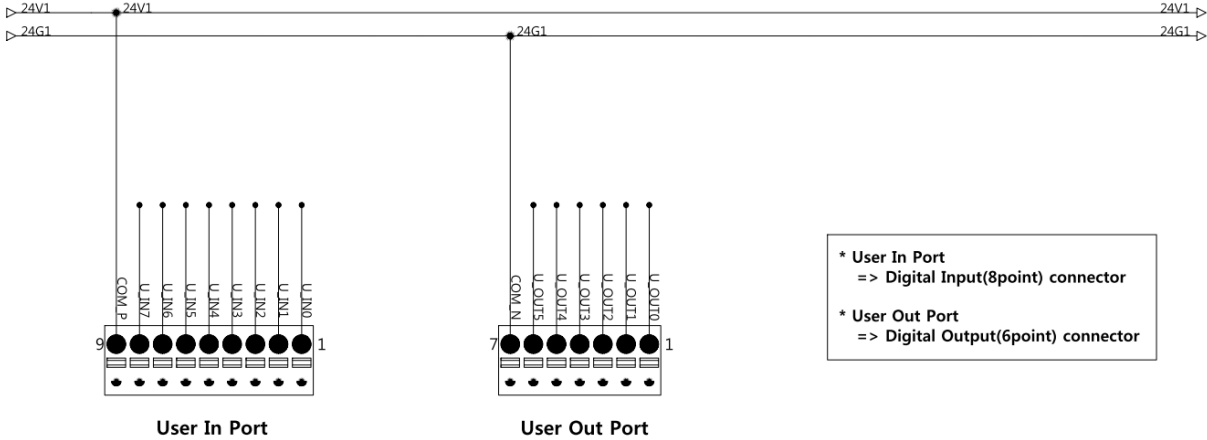
- It has Digital I/O (Input = 8point, Output = 6point).
- If use Digital I/O, supply the power to I/O common. (Input common : DC24V, Output common : GND)

7.9. Brake In/Out
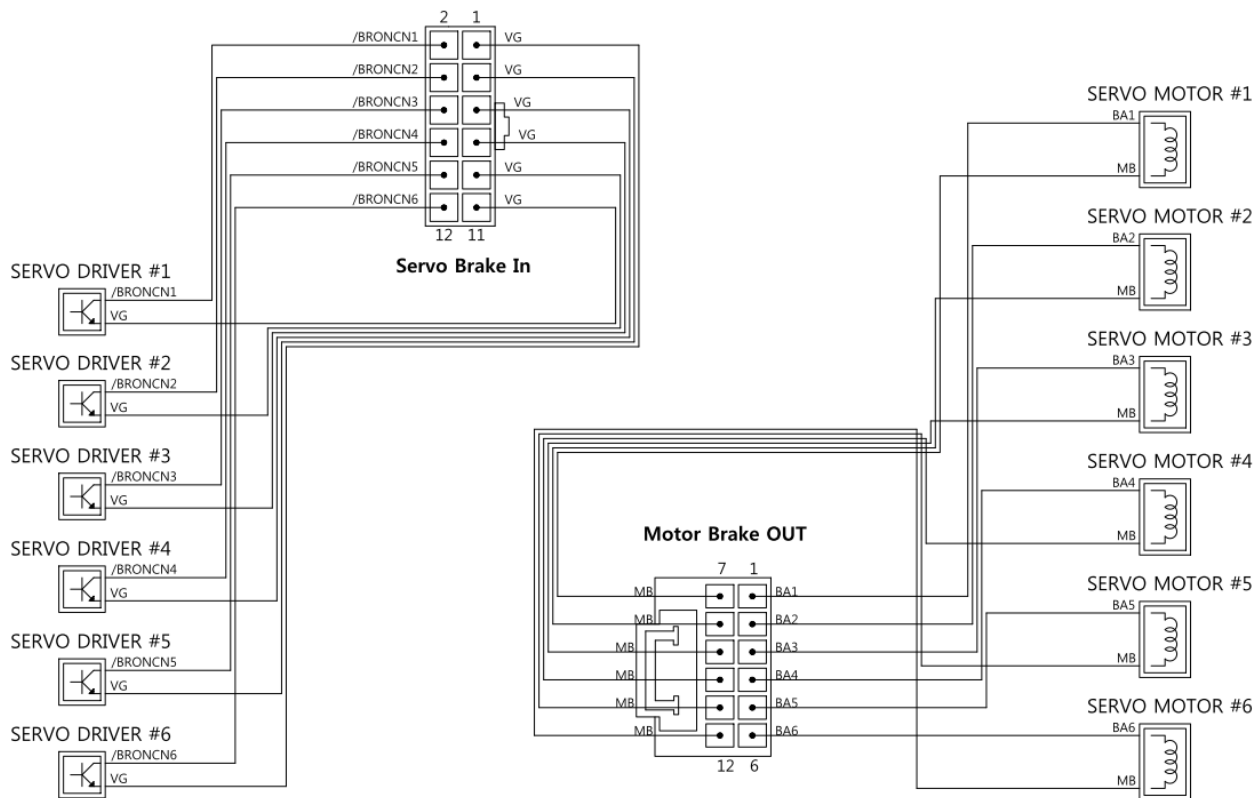
- It is not necessary to configure the brake circuit by providing the brake circuit using the FET.
- The output operates according to the brake input of each axis. (DRSC-HA does not control the brake).
- Brake I / O can be connected up to 6 axes.
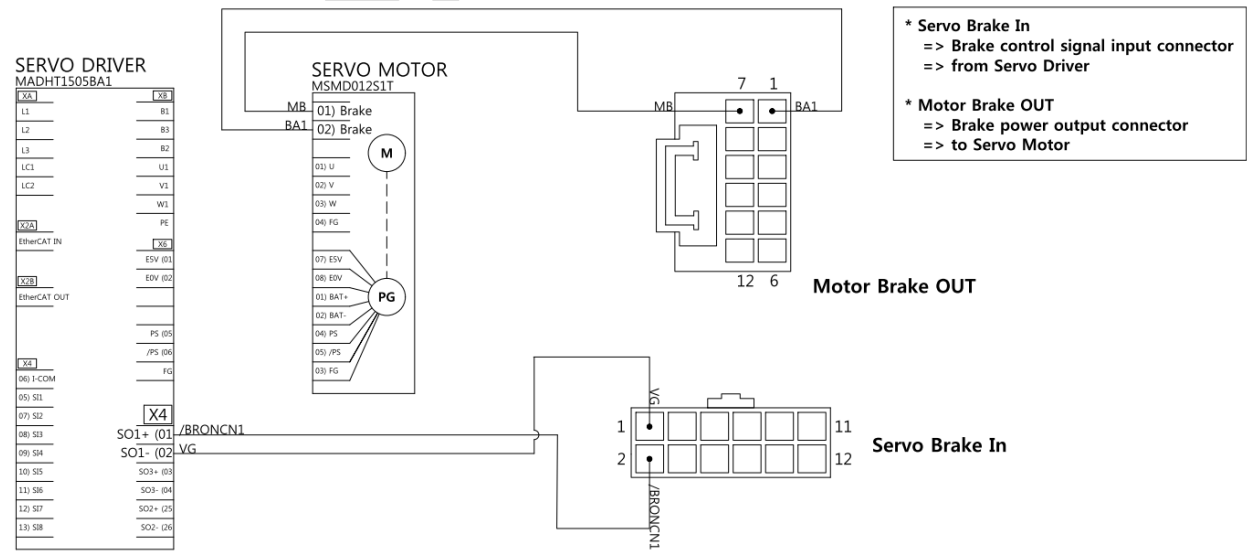
- This is an example of 1 axis connection. (Between Panasonic servo driver and servo motor)

8. Connectors

8.1. Connector description

No	Drawing	Reference	Description	Part Number	Qt'y(EA)	Maker
1		MC1 MC2 Limit Safety Guard	Dynamic series connector Dynamic D-2100, 2.50mm pitch, 6pin(2-row)	1-1318119-3	3	TE
2			Contact crimp socket	1318107-1	18	TE
3		T/P Interface Motor Brake OUT	Dynamic series connector Dynamic D-2100, 2.50mm pitch, 12pin(2-row)	1-1318118-6	2	TE
4			Contact crimp socket	1318107-1	24	TE
5		EMO	Dynamic series connector Dynamic D-1200, 4pin(2-row)	1-1827864-2	1	TE
6			Contact crimp socket	1871731-1	4	TE
7		System IO Servo Brake IN	C-GRID Ⅲ series connector C-GRID Ⅲ 90130, 2.54mm pitch, 12pin(2-row)	90142-0012	2	MOLEX
8			Contact crimp socket	90119-2109	24	MOLEX
9		Safety Guard	C-GRID Ⅲ series connector C-GRID Ⅲ 90130, 2.54mm pitch, 18pin(2-row)	90142-0018	1	MOLEX
10			Contact crimp socket	90119-2109	18	MOLEX
11		Main Power	MPC300 series connector MPC300, 3.50mm pitch, 3pin	MPC300-350-03	1	DECA
12		Brake Power	MPC300 series connector MPC300, 5.00mm pitch, 3pin	MPC300-500-03	1	DECA
13		CAN	MPC300 series connector MPC300, 3.50mm pitch, 5pin	MPC300-350-05	1	DECA
14		User Out Port	MPC300 series connector MPC300, 3.50mm pitch, 7pin	MPC300-350-07	1	DECA
15		User In Port	MPC300 series connector MPC300, 3.50mm pitch, 9pin	MPC300-350-09	1	DECA
16		RS232	SMH series connector SMH200, 2.00mm pitch, 3pin	SMH200-03	1	YEONHO
17			Contact crimp socket	YST200	3	YEONHO

8.2. Power

Reference	No	Name	Direction	Function
Main Power	1	24V	IN	+24V Power
	2	F.G	OUT	Frame ground
	3	GND	IN	24V GND
Brake Power	1	PREPB	IN	+24V Power
	2	F.G	OUT	Frame ground
	3	MB	IN	24V GND

8.3. System IO

Reference	No	Name	Direction	Function
System IO	1	VDD24V	OUT	+24V Power
	2	VG	OUT	24V GND
	3	/MP_ON	IN	Motor power on state lamp. Connect to lamp(24VDC) with VDD24V.
	4	SW_MPON	IN	Motor power on switch. Connect to A contact switch with VG.
	5	/RUN	IN	Program run state lamp. Connect to lamp(24VDC) with VDD24V.
	6	SW_RUN	IN	Program run switch. Connect to A contact switch with VG.
	7	/ERR	IN	Error state lamp. Connect to lamp(24VDC) with VDD24V.
	8	SW_CLEAR	IN	Error clear switch. Connect to A contact switch with VG.
	9	/SP_OUT1	-	-
	10	SW_SP	-	-
	11	M_FAULT	-	-
	12	VG	OUT	24V GND

8.4. EMO

Reference	No	Name	Direction	Function
EMO	1	VDD24V	OUT	Emergency switch channel-1. Connect to B contact switch.
	3	EMOP1	IN	
	2	VG	OUT	Emergency switch channel-2. Connect to B contact switch.
	4	/EMOP2	IN	

8.5. T/P Interface

Reference	No	Name	Direction	Function
T/P Interface	1	VDD24V	OUT	+24V Power
	2	/EMTP1	IN	T/P Emergency switch channel-1. Connect to B contact switch with VDD24V.
	3	/SEL2	IN	T/P Select switch channel-1 Connect to C contact switch with VDD24V.
	4	/SWEN1	IN	T/P Enabling switch channel-1 Connect to A contact switch with VDD24V
	5	-	-	-
	6	VG	OUT	24V GND
	7	VDD24V	OUT	+24V Power
	8	EMTP2	IN	T/P Emergency switch channel-2. Connect to B contact switch with VG.
	9	SEL1	IN	T/P Select switch channel-2. Connect to C contact switch with VG.
	10	SWEN2	IN	T/P Enabling switch channel-1 Connect to A contact switch with VG.
	11	-	-	-
	12	VG	OUT	24V GND

8.6. MC 1/2

Reference	No	Name	Direction	Function
MC1	2	/MC1	IN	MC1 monitoring. Connect to NO contact (In MC).
	3	VG	OUT	
	1	VDD24V	OUT	MC1 control (24VDC output). When a motor power on signal is input, power is output.
	4	/MCON1	OUT	
	5	MCON1P	OUT	MC1 control (Relay contact). When a motor power on signal is input, contact is closed.
	6	MCON1N	OUT	
MC2	1	VDD24V	OUT	MC1 monitoring. Connect to NO contact (In MC).
	2	MC2	IN	
	3	VG	OUT	MC2 control (24VDC output). When a motor power on signal is input, power is output.
	4	MCON2	OUT	
	5	MCON2P	OUT	MC2 control (Relay contact). When a motor power on signal is input, contact is closed.
	6	MCON2N	OUT	

8.7. Safety Guard

Reference	No	Name	Direction	Function
Safety Guard	1	EX24V	IN	+24V Power
	2	EX24V	IN	+24V Power
	3	SG1-	IN	Auto mode safety guard 1. Connect to B contact sensor.
	4	SG1+ (+24V)	OUT	
	5	ES1-	IN	External Safety guard 1. Connect to B contact sensor.
	6	ES1+ (+24V)	OUT	
	7	SG2-	IN	Auto mode safety guard 2. Connect to B contact sensor.
	8	SG2+ (+24V)	OUT	
	9	ES2-	IN	External Safety guard 2. Connect to B contact sensor.
	10	ES2+ (+24V)	OUT	
	11	EMOUT1+	OUT	Emergency monitoring 1 (Relay contact). If there is a problem with the emergency switch, contact will be open.
	12	EMOUT1-	OUT	
	13	EMOUT2+	OUT	Emergency monitoring 2 (Relay contact). If there is a problem with the emergency switch, contact will be open.
	14	EMOUT2-	OUT	
	15	EXMON	-	-
	16	SAFE_COM	IN	24V GND
	17	SAFE_COM	IN	24V GND
	18	SAFE_COM	IN	24V GND

8.8. Limit Safety Guard

Reference	No	Name	Direction	Function
Limit Safety Guard	1	LSOVT1- (GND)	OUT	Limit sensor 1. Connect to B contact sensor.
	2	LSOVT1+	IN	
	3	-	-	-
	4	LSOVT2-	IN	Limit sensor 2. Connect to B contact sensor.
	5	LSOVT2+ (+24V)	OUT	
	6	-	-	-

8.9. User In/Out Port

Reference	No	Name	Direction	Function
User In Port	1	U_INPUT0	IN	User digital input 0
	2	U_INPUT1	IN	User digital input 1
	3	U_INPUT2	IN	User digital input 2
	4	U_INPUT3	IN	User digital input 3
	5	U_INPUT4	IN	User digital input 4
	6	U_INPUT5	IN	User digital input 5
	7	U_INPUT6	IN	User digital input 6
	8	U_INPUT7	IN	User digital input 7
	9	COMIN1_P	IN	User digital input common (+24V)
User Out Port	1	U_PROUT0	OUT	User digital output 0
	2	U_PROUT1	OUT	User digital output 1
	3	U_PROUT2	OUT	User digital output 2
	4	U_PROUT3	OUT	User digital output 3
	5	U_PROUT4	OUT	User digital output 4
	6	U_PROUT5	OUT	User digital output 5
	7	COM_N	IN	User digital output common (GND)

8.10. Brake In/Out

Reference	No	Name	Direction	Function
Servo Brake IN	1	VG	OUT	Axis 1 brake control signal input From servo driver
	2	/BRONCN1	IN	
	3	VG	OUT	Axis 2 brake control signal input From servo driver
	4	/BRONCN2	IN	
	5	VG	OUT	Axis 3 brake control signal input From servo driver
	6	/BRONCN3	IN	
	7	VG	OUT	Axis 4 brake control signal input From servo driver
	8	/BRONCN4	IN	
	9	VG	OUT	Axis 5 brake control signal input From servo driver
	10	/BRONCN5	IN	
	11	VG	OUT	Axis 6 brake control signal input From servo driver
	12	/BRONCN6	IN	
Motor Brake OUT	1	BA1 (+24V)	OUT	Axis 1 brake control power (24VDC). When a brake control signal is input, power is output to servo motor.
	7	MB (GND)	OUT	
	2	BA2 (+24V)	OUT	Axis 2 brake control power (24VDC). When a brake control signal is input, power is output to servo motor.
	8	MB (GND)	OUT	
	3	BA3 (+24V)	OUT	Axis 3 brake control power (24VDC). When a brake control signal is input, power is output to servo motor.
	9	MB (GND)	OUT	
	4	BA4 (+24V)	OUT	Axis 4 brake control power (24VDC). When a brake control signal is input, power is output to servo motor.
	10	MB (GND)	OUT	
	5	BA5 (+24V)	OUT	Axis 5 brake control power (24VDC). When a brake control signal is input, power is output to servo motor.
	11	MB (GND)	OUT	
	6	BA6 (+24V)	OUT	Axis 6 brake control power (24VDC). When a brake control signal is input, power is output to servo motor.
	12	MB (GND)	OUT	

8.11. EtherCAT In/Out

Reference	No	Name	Direction	Function
EtherCAT IN	1	TX1+	OUT	EtherCAT Transmit data +
	2	TX1-	OUT	EtherCAT Transmit data -
	3	RX1+	IN	EtherCAT Receive data +
	4	TX2+	OUT	-
	5	TX2-	OUT	-
	6	RX1-	IN	EtherCAT Receive data -
	7	RX2+	IN	-
	8	RX2-	IN	-
	-	CHGND	OUT	EtherCAT cable shield
EtherCAT OUT	1	TX1+	OUT	EtherCAT Transmit data +
	2	TX1-	OUT	EtherCAT Transmit data -
	3	RX1+	IN	EtherCAT Receive data +
	4	TX2+	OUT	-
	5	TX2-	OUT	-
	6	RX1-	IN	EtherCAT Receive data -
	7	RX2+	IN	-
	8	RX2-	IN	-
	-	CHGND	OUT	EtherCAT cable shield

8.12. CAN (Optional)

Reference	No	Name	Direction	Function
CAN	1	PREP5	IN	+5V Power
	2	CAN_H1	I/O	CAN high
	3	CHGND	OUT	Frame ground
	4	CAN_L1	I/O	CAN low
	5	PREG5	IN	5V GND

8.13. RS232 (Optional)

Reference	No	Name	Direction	Function
RS232	1	GND	OUT	GND
	2	TX	OUT	RS-232 Transmit data
	3	RX	IN	RS-232 Receive data

9. Switchs

9.1. Brake Switch

Reference	No	Name	Direction	Function
Axis 1	-	-	-	Axis 1 Manual brake release switch
Axis 2	-	-	-	Axis 2 Manual brake release switch
Axis 3	-	-	-	Axis 3 Manual brake release switch
Axis 4	-	-	-	Axis 4 Manual brake release switch
Axis 5	-	-	-	Axis 5 Manual brake release switch
Axis 6	-	-	-	Axis 6 Manual brake release switch

9.2. External Guard/Limit Disable Switch

Reference	No	Name	Direction	Function
SEL1	1	LSG2	-	Limit sensor 2 Use/Unuse select switch
	2	LSG1	-	Limit sensor 1 Use/Unuse select switch
SEL2	1	ES2	-	External safety guard 2 Use/Unuse select switch
	2	SG2	-	Auto mode safety guard 2 Use/Unuse select switch
	3	ES1	-	External safety guard 1 Use/Unuse select switch
	4	SG1	-	Auto mode safety guard 1 Use/Unuse select switch

10. Safety

This safety information covers functions related to the operation of industrial robots.
This information does not cover how to design, install, and operate the entire system and does not cover all peripherals that may affect the overall system safety.
To protect personnel, the entire system must be designed and installed in accordance with the safety requirements outlined in the national standards and regulations in which the robot is installed.
Users of our controllers are responsible for ensuring that the safety devices required to comply with the relevant safety laws and regulations of their country and to protect people using the robotic system are properly designed and installed.
Robot handlers should be familiar with the handling and handling of industrial robots. Never change a diskette containing the robot's control program in the user's guide or product manual, as this may lead to the disabling of safety functions such as speed reduction.

In addition to the built-in safety functions, the robot also has an interface for connecting external safety devices.
This interface allows external safety functions to interact with other machines and peripherals. This means that the control signal can act on the safety signal received from the robot as well as the peripheral device. The product manual / installation provides instructions for connecting safety devices between the robot and the peripherals.

10.1. Safety standards applied

DAIN Robot Safety Controller (DRSC) is applicable to robots that require the following specifications.

	The manipulator system is designed in accordance with the requirements of:	
	Standard	**Description**
Standards EN ISO	EN ISO 12100 -1	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology
	EN ISO 12100 -2	Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles
	EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
	EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
	ENISO10218-1	Robotsforindustrialenvironments-SafetyrequirementsPart1Robot
	EN ISO 9787	Manipulating industrial robots, coordinate systems, and motion nomenclatures
	EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
	EN ISO 14644-1	Classification of air cleanliness
	EN ISO 13732-1	Ergonomics of the thermal environment - Part 1
	EN IEC 61000-6-4	EMC, Generic emission
	EN IEC 61000-6-2	EMC, Generic immunity
	EN IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
	IEC 60529	Degrees of protection provided by enclosures (IP code)
Standards European	EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
	EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design
	EN 953	Safety of machinery - General requirements for the design and construction of fixed and movable guards
Standard Other	ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
	ANSI/UL 1740	Safety standard for robots and robotic equipment
	CAN/CSA Z434-03 (option 429-1)	Industrial robots and robot Systems - General safety requirements

10.2. Fire extinguish

Please use the CARBON DIOXIDE fire extinguisher to extinguish a fire in a robot (instrument, controller).

10.3.   Definition of safety functions

■ Emergency stop - IEC 204-1,10.7
  • Ignores all other robot controls, removes drive power from the robot axis actuator, stops all moving parts, and removes power from other dangerous functions controlled by the robot.

■ Enabling device – ISO 11161, 3.4
  • This is a manually operated device. If you continue to operate only in one location, there is a dangerous function, but it will not work. You can safely stop dangerous functions from other locations.

■ Safety stop – ISO 10218 (EN 775), 6.4.3
  • If a safety stop circuit is provided, each robot must be provided with the necessary safety devices for the circuit and associated interlocks. You must reset the power of the mechanical actuator before starting the robot operation.
  • However, if only the power of the mechanical actuator is reset, it is not sufficient to start operation.

■ Reduced speed – ISO 10218-1 (EN 775), 3.2.17
  • At a selectable single speed provided by the robot supplier, it automatically limits the robot speed to the specified speed to allow enough time for the robot to withdraw from the critical area or stop the robot.

■ Interlock (for safeguarding) – ISO 10218-1 (EN 775), 3.2.8
  • The ability to interconnect the guard or device with the robot controller or the power system of the robot and associated equipment.

■ Hold-to-run control – ISO 10218-1 (EN 775), 3.2.7
  • Controls that can be moved only during manual operation, and controls that stop when you release them

10.4. Safe Working Procedures

■ Use safe working procedures to prevent injury. Safety devices or circuits may not be modified, circumvented or altered at any time.

10.5. Programming, Test and Services

■ Robots are very heavy and powerful even low speed. When entering the safety zone of a robot, it is necessary to comply with the applicable safety regulations of the country concerned. The operator must be aware that the robot can behave unexpectedly. Stop (stop) in the movement pattern can move to high speed. The operator must also be aware that external signals can affect the robot program in such a way that certain behavior patterns are changed without warning.

■ If you need to perform tasks within the robot's scope of work, you must:
  • The operating mode selector on the controller must be in the manual mode position to activate the operating unit and disable operation from the computer link or remote control panel.
  • The speed of the robot is limited to the speed below.
    250 mm / s in Manual Mode. This location should be normal when entering a workspace.
  • During programming and testing, you must release the actuator as soon as you do not need to move the robot.
    The enabling device should not operate in any way.
  • The programmer must always bring a Teach Pendant with him when passing through the Safety Guard in the robot workspace so that no one can control the robot without his instructions.

10.6. The safety control chain of operation

The safety control chain is based on a dual electrical safety chain that interacts with the robot computer and activates the MOTORS ON mode.

Each electrical safety chain is connected in such a way that all switches must be closed before multiple switches are connected and the robot is set to MOTORS ON mode. MOTORS ON mode means that drive power is supplied to the motor. When the contact in the work safety chain is open, the robot always returns to MOTORS OFF mode. MOTORS OFF mode means that the driving force is removed from the motor of the robot and the brake is applied.

The status of the switch is indicated by the LAMP on the panel module of the control cabinet and also on the Tie Pendant (I/O screen). After stopping, the switch must be reset on the previously stopped device.
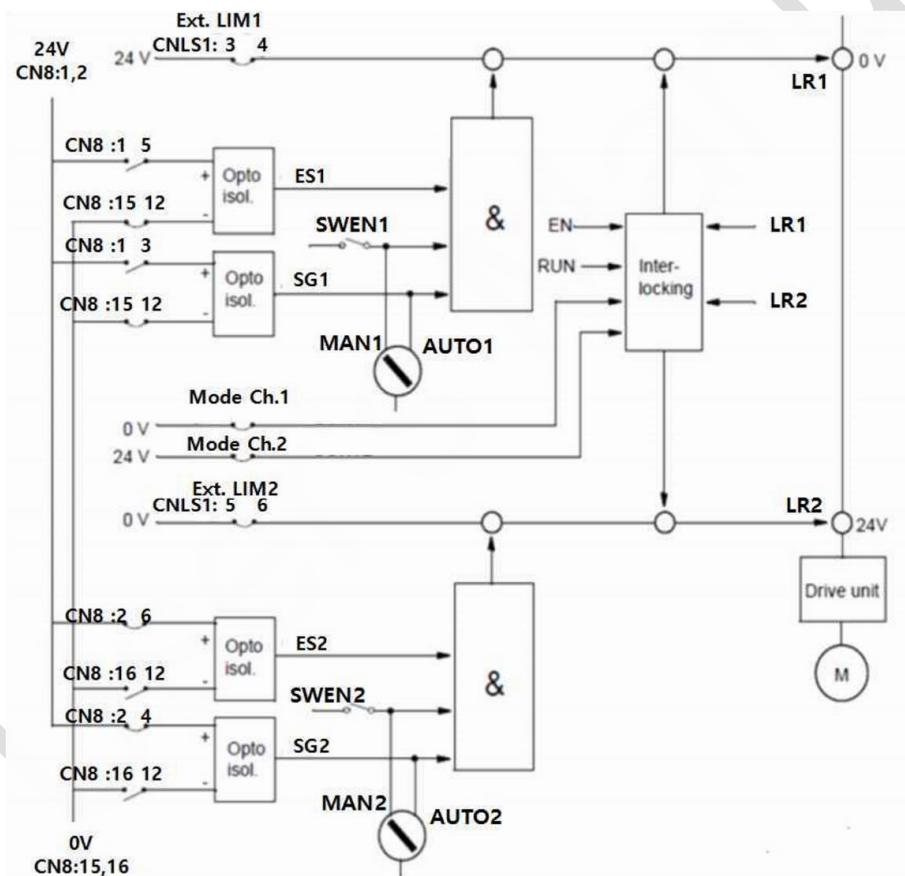
You can be instructed to restart the robot.

The center two channel cycle monitoring period of the safety control chain is 4ms.

Safety chains should never be diverted, modified or altered in any other way.

10.7. Emergency stop

Emergency stop must be activated if there is a risk to personnel or equipment. The built-in emergency stop button is located on the operator panel of the robot controller and on the teach pendant.

An external emergency stop device (button, etc.) allows the user to connect to the safety chain (see the product manual / installation). It must be connected according to the applicable standards for the emergency stop circuit. You should check all emergency stop buttons or other safety equipment before commissioning the robot to check its operation. Set the reason for the stop before switching back to MOTORS ON mode. Correct the error.

10.8.   Select operation mode

The corresponding safety requirements for the use of robots specified in ISO 10218-1 are available in a number of modes, with the selection device being selected as a clear location.

You can use one manual mode and two auto modes.

- ■ Manual mode

  <Deceleration operation at the speed of 250 mm/s> Anyone must select it when entering the safety space of the robot. The robot must be operated with a teach pendant and must be used as an enabling switch. In this mode (automatic mode), the safeguard (SG) function is not activated.

- ■ Auto mode

  Safety devices, such as device doors, gates, light curtains, light beams and safety mats, can be activated while still active.

  No one can enter the safe space of the robot. All controls, such as emergency stop, control panel and control cabinet, should be easily accessible outside the protected area.

  Automatic operation is possible when the following conditions are met.

- • AUTO mode is set.

- • MOTORS ON Switch ON state.

- • Press RUN Key.

- • Safety device activation status (SG, ESG, etc.).

10.9. Use Enabling Device

When the operation mode selector is in MANUAL, you can press the actuator of the teach pendant to turn on the robot's motor.

If the robot must return to MOTORS OFF for any reason while the actuator is depressed, it must be released before returning the robot to MOTORS ON mode. This is a safety feature designed to prevent the actuator from becoming inactive.

When the actuator is released, the motor's drive power is turned off, the brake is applied, and the robot returns to the MOTORS OFF state.

When the activation device is reactivated, the robot changes to the MOTORS ON state.

10.10. External Safety Guard (ESG) connection

ESG connections are provided for interlocking external safeguards such as light curtains, light beams or sensitive mats. The ESG operates regardless of the position of the operating mode selector.

When this connection is opened, the robot switches to MOTORS OFF mode. To reset to MOTORS ON mode, the device that initiated the safety shutdown must be interlocked in accordance with the applicable safety regulations. This is usually done by resetting the device itself.

10.11. Automatic Safety Guard (SG) connection

SG connections are provided for interlocking internal safeguards such as light curtains, light beams, or photosensitive mats used externally by system builders. SG is intended for use in auto mode, especially during normal program execution. When the operation mode selector is changed to MANUAL, SG is bypassed.

10.12. Workspace Restrictions

For certain applications, movement to the robot's major axis must be restricted to create a sufficiently large safety zone. This reduces the risk of damage to the robot if it collides with an external safety device such as a barrier.

The movement for axes 1, 2 and 3 can be restricted using an adjustable mechanical stop or an electrical limit switch. If the workspace is restricted to a stop or switch, you must also change its software restriction parameters. Computer software can move three wrist axes if necessary. You must limit the movement of the axis.

10.13. Precautions during installation and service

Do not use the robot as a ladder. Do not ride with a robot motor or other robot. During servicing, there is a risk of slipping due to parts, height, or the temperature of the motor or oil spill that can occur in the robot.

To avoid injury and damage during installation of the robot system, it is necessary to comply with the regulations applicable in your country and the instructions of our controller manual.

Particular attention should be paid to:

- The entire system vendor must ensure that all circuits used for safety functions are interlocked in accordance with the applicable standard for the function.
- Be sure to follow the instructions in the product manual / installation.

- The power supplied to the robot must be connected so that it can be switched off the robot's work area.
- The entire system supplier must ensure that all circuitry used for the emergency stop function is interlocked in a secure manner in accordance with the appropriate standard for the emergency stop function.
- The Emergency Stop button should be placed in an easily accessible location to allow the robot to stop quickly.
- Safety zones that must cross before admittance must be installed in front of the robot's workspace. A light beam or a sensitive mat is a suitable device.
- The operator must use a turntable or the like to move away from the robot's workspace.
- The task chief must ensure that there are safety instructions for the installation.
- The person installing the robot must be properly trained in the robot system and its associated safety issues.
  If you need to perform troubleshooting with the power supply turned on, you must also restore the fault, disconnect the electrical leads, and turn off the robot when disconnecting or connecting the device. (By setting the main switch to OFF).
  Even if the robot's power supply is turned off, it can still be injured.
- The axis is affected by gravity when the brake is released. There is a risk of moving the robot parts as well as a risk of tie rods breaking down.
- To balance a particular axis, the energy stored in the robot can be released when the robot or part of it is disassembled.
- Be careful of falling objects when disassembling / assembling machinery.

11. General care and maintenance

Your device is a product of superior design and craftsmanship and should be treated with care.

The following suggestions will help you.

- Keep the device dry. Precipitation, humidity, and all types of liquids or moisture can contain minerals that will corrode electronic circuits. If your device does get wet, allow it to dry completely.
- Do not use or store the device in dusty, dirty areas. Its moving parts and electronic components can be damaged.
- Do not store the device in hot areas. High temperatures can shorten the life of electronic devices, damage cable, and warp or melt certain plastics.
- Do not store the device in cold areas. When the device returns to its normal temperature, moisture can form inside the device and damage electronic circuit boards.
- Do not attempt to open the device.
- Do not drop, knock, or shake the device. Rough handling can break internal circuit boards and fine mechanics.
- Do not paint the device. Paint can clog the moving parts and prevent proper operation.
- Unauthorized modifications or attachments could damage the device and may violate regulations governing radio devices.

11.1. Cleaning

To clean the pendant, use a soft cloth dampened with a small amount of water or a mild cleaning agent.

12. EC directives and standards

The list of safety standards on the robot. This section does not cover the safety design methods and safety equipment installation.

12.1. EC directives

2006/42/EC Directive for the safety of machinery with the application MD 2006/42/EC
2004/108/EC EMC directive
2011/65/EC RoHS directive

12.2. Standards

EN ISO 12100: Safety of machinery - General principles for design – Risk assessment and risk reduction

EN ISO 13849-1: Safety of machinery, safety related parts of control systems
        -Part 1: General principles for design

EN ISO 13850: Safety of machinery - Emergency stop - Principles for design

EN ISO 10218-1: Robots for industrial environments - Safety requirements -Part1 Robot

EN ISO 9787: Robots and robotic devices -- Coordinate systems and motion nomenclatures

EN ISO 9283: Manipulating industrial robots, performance criteria, and related test methods.

EN ISO 13732-1: Ergonomics of the thermal environment - Part 1

EN 61000-6-4(2007+A1:2011): Terminal disturbance voltage, Radiated disturbance

EN 61000-3-2:2014: Harmonic Distortion

EN 61000-3-3:2013: Voltage fluctuations & flicker

EN 61000-6-2:2005: Include below test types

EN 61000-4-2:2009: Electrostatic discharge

EN 61000-4-3:2006 +A1:2008+A2:2010: Radiated, radio-frequency, electromagnetic field

EN 61000-4-4:2004 +A1:2010: Electrical fast transient / burst

EN 61000-4-5:2006: Surge

EN 61000-4-6:2009: Conducted disturbances, induced by radio-frequency fields

EN 61000-4-8:2010: Power frequency magnetic field

EN 61000-4-11:2004: Voltage dips, short interruptions and voltage variations

Korea Standard

KN 61000-6-3 : Conducted tests (mains port), electromagnetic conduction test (communication ports)

KN 14-1 : Discontinuous disturbance test

KN 61000-6-3 : Electromagnetic radiation test

KN 61000-6-1, KN 61000-4-2: Electrostatic discharge immunity test

KN 61000-6-1, KN 61000-4-3: Radiated RF electromagnetic field immunity test

KN 61000-6-1, KN 61000-4-4: EFT/_Burst immunity test

KN 61000-6-1, KN 61000-4-5: Surge immunity test

KN 61000-6-1, KN 61000-4-6: Conducted immunity test

KN 61000-6-1, KN 61000-4-8: Power frequency magnetic field immunity test

KN 61000-6-1, KN 61000-4-11: Voltage drop and momentary power failure immunity test

Check the local regulations for disposal of electronic products.

This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste.
Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment.
The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

We hereby declare that the product is in compliance with the essential requirements and other relevant provisions of European Directive 2014/30/EC(The Electromagnetic Compatibility Directive).

We hereby declare that the product is in compliance with the essential requirements and other relevant provisions of Korea Directive (EMC standards)
Standard: Information Communication equipment such notice with regard to the assignment and management of the laboratory